Editorial

TODAY, the sight and sound of great airliners thundering into the sky is commonplace. Interstate travellers take them almost as a matter of course, where once they would just as automatically have taken a train. In every theatre, full-color wide-screen pictures show us what it is like to wing our way across far-flung lands.

But, despite all that, the impact of spanning the world in three days seems to escape one. Figures, words and pictures remain just what they are.

To do it yourself, to watch the coastline of many lands advance and recede during the daytime, and the glowing furnace of the engines during the night, underlines indelibly in one's mind the vanishing limits of time and distance.

In half of a work-a-day week, one is whisked from the hustle and heat of a Sydney summer, through the smells and anomalies of the near East, across the cradles of ancient learning into the last ravages of a European winter. Yet it isn't really so long ago that the same journey would have taken weeks of time.

Nor have we reached the ultimate. Soon today's flying time will be reduced by faster and smoother aircraft. Averaging a mere 260 mph will seem intolerably slow.

But if the world is shrinking in a commercial sense, then how much smaller is it in terms of military operations? Already, behind a veil of secrecy, guided missiles seem to have reached the stage where they can destroy targets hundreds of miles from where they are launched. Strategists are planning for—and against—missiles which are capable of spanning oceans and continents at fantastic speeds and carrying "warheads" of fantastic power.

In 1914-18, the term "World War" signified the immense area over which the warring nations were spread. In any future conflict the world will be much too small a place in which to be!

Elsewhere in the issue are a few preliminary observations I have been able to record about radio and television in Italy. They are just observations, at this stage, without any pretence to purpose or continuity. When one is trying to cram so much into such a relatively short time, it is a big enough task to visit, to examine and discuss the things of immediate interest, without trying at the same time to record it all in polished prose.

John Moyle

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RADIO
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OUR COVER PICTURE

This huge dome, slung beneath the fuselage of a Lockheed Super Constellation, houses equipment which is an essential part of the US early warning radar system. Compare its size with the man standing alongside.

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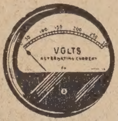

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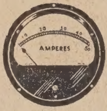

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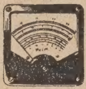

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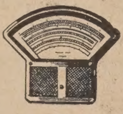

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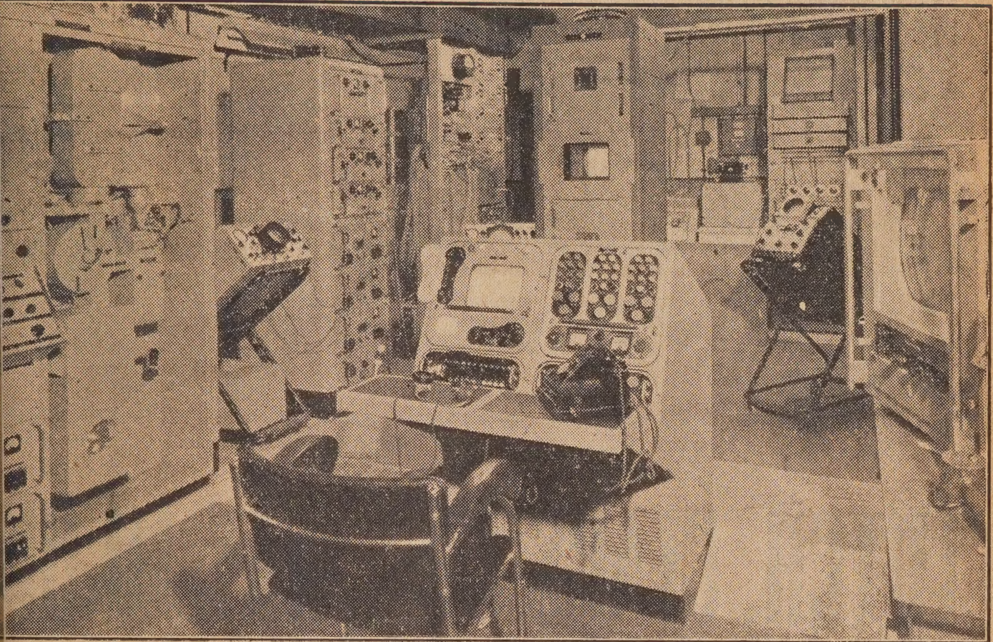
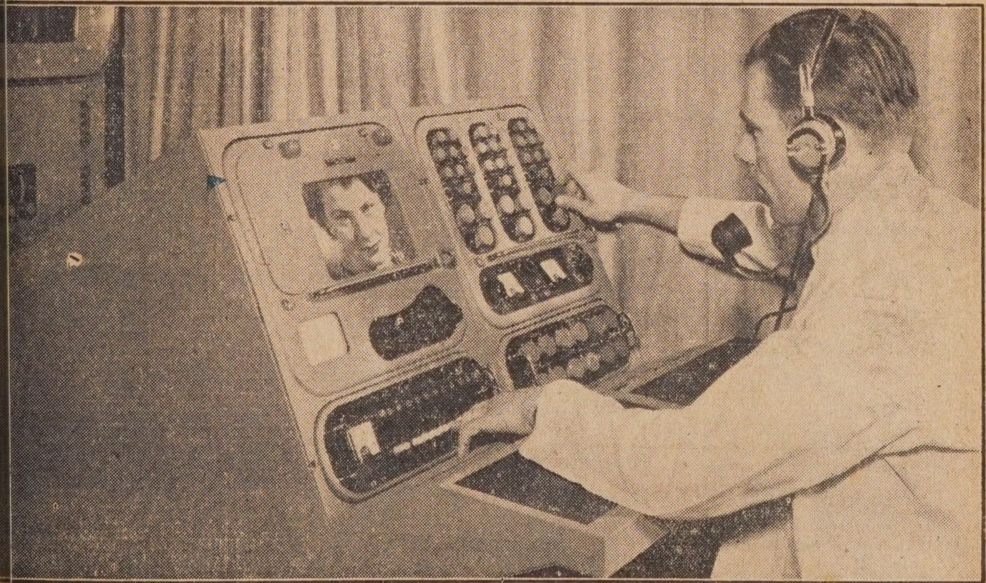
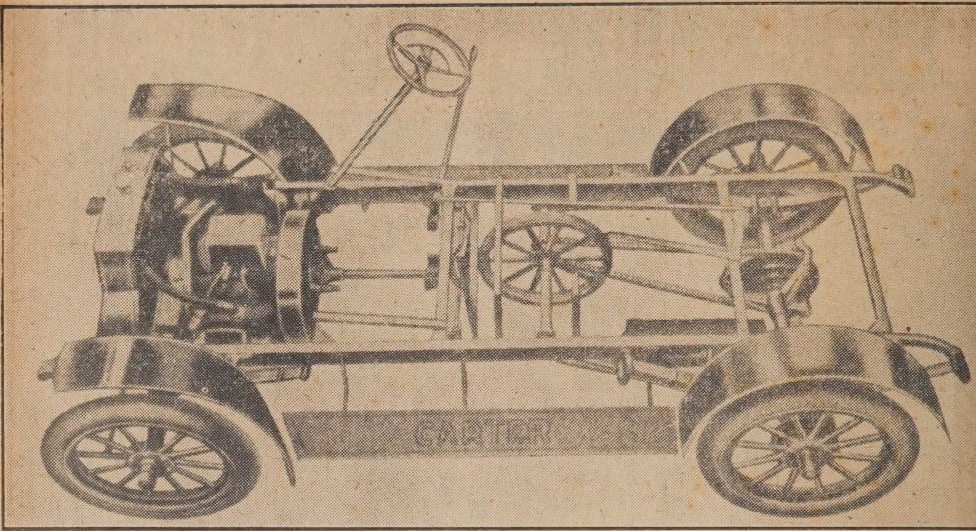
BBC TRIES OUT COLOR TELEVISION



e British Broadcasting Corporation is currently experimenting with color TV. On the left is the film scanner and its associated quipment. A dichroic 3-tube color monitor is at the far end of the room, while the pulse generators are ranged along the right-hand wall.



close-up of the camera control console, with a picture on the monitor screen. By turning his head to the right, the operator can npare this with the image on a typical receiver, just visible in the top photograph. (See also page 13).



The Carter friction transmission, which gave an infinite variation in forward and reverse speeds, without the use of a clutch or ge box.

CLUTCH, GEARS GIVE WAY TO OI

The automatic transmission, which features in most 1956 cars, is not just a postwar sales feature. It is the culmination of a long developmental program, during which automotive engineers often had to learn the hard way.

RECENTLY, a motorist drove his Cadillac into the local dealer in Hartford, Connecticut, and asked if they could "fix the thingamabob which drives the automatic transmission." "Sure" came the reply.

The mechanics were staggered when, a few minutes later, a 1906 Model K Runabout rolled through the doors. The Cadillac had automatic transmission all right! It drove the car through two forward speeds and reverse by means of a clutchless lever.

What is new about effortless gear changes is the fact they are being adopted faster by overseas manufacturers than any other motoring innovation since four-wheeled brakes.

FOR ALL CARS

Every US manufacturer without exception offers automatic transmission as optional equipment and even the redoubtable British Rolls-Royce company are building the GM Hydramatic under licence.

So pedal-less gear shifting is here to stay — after a long and uncertain life history.

In addition to the Cadillac, other forms of automatic transmission were on the market before 1910.

There was the Carter friction drive car, for instance, which had a friction plate at the back of the flywheel running at a tangent to another friction wheel coupled to the rear axle. The idea was excellent, because it gave an infinite variable ratio. However, the makers were never able to surmount metallurgical problems and the company finally sold out.

Another early example of automatic transmission was the Owen Magnetic Electrical drive which used a series of powerful electric magnets to control the gear ratio. Although excellent in design, the unit was a financial failure due to its size and weight. The French, amused by the American efforts, also tackled the problem. They used a principle almost as old as Paris itself — the Constantinesco Mass-Inertia Drive — which made use of the moment of inertia of a hinged weight set in motion by a force.

The big drawback of this system was the need for a series of ratchets to transfer the motion from an oscillating movement to a driving force.

by Pedr Davis

The French engineers, too, were beset by metallurgical troubles eventually abandoned the idea.

Other European inventors exp mented through the years with genious variations on electric hydraulic drives. A German, H mann Fottinger, pioneered hydraulic type of clutch we now kr as the fluid flywheel. This unit since been adapted to provide basis of the torque converter — very heart of automatic transmissi

DIFFERENT OPERATION

However, although similar fron construction point of view, the ea fluid flywheel and the mod hydraulic torque converter di greatly in their operation.

When a man jabs a crowbar i a door to force it open, he is a to exert extra leverage known "moment". It is equal to the fo he exerts multiplied by the len of the bar.

"Torque" is a similar kind of for except that it is only applied something which is rotating. Eng eers define it as a "turning momen meaning that it is a twisting for

Mechanically it is quite a sim matter to multiply torque without creasing the force. It is mer necessary to lengthen the dista through which it is applied — as in our crowbar illustration.

Gearboxes are mechanical dev

which do just that. The force is onstant, for a uniform engine speed. The ratios of the different speed wheels (or gears) effectively alter he distance through which the ngine torque is applied. They thereore increase the torque.

Now, it is well known that action nd reaction are equal and opposite. If a torque is applied in one direcion, it must be balanced by an oposing force in the opposite direction. As a result a gearbox has a tendency to turn in the opposite direction to the propeller shaft, which calls for torque reaction member to balance the torque, as it changes with diferent ratios. Usually it is sufficient to bolt the gearbox firmly to the ngine block.

Having made the point, we can iscover the essential difference beween a fluid flywheel and a torque onverter.

PIN TOGETHER

A fluid flywheel consists of a pump nd a turbine in very close proximy. The working medium is oil and the pump spins, the turbulence the fluid causes the turbine to otate.

At low speeds, the action on the rbine blades is not enough to turn e drive shaft but as the speed of e pump increases so also does the ndency to spin the turbine. At a itical speed, both the pump and e turbine will be turning with qual velocity and with the same ower (less slight frictional losses) nd with no change in torque.

In practice, the fluid flywheel consists of two rotating discs. One is iven by the engine and the other coupled to the drive shaft of the r. Light mineral oil separates the wo.

If a third disc is fitted to the unit, laced between the pump and the rbine, it can function as a torque actor and it is then possible to e the fluid clutch as a "gearbox" as well.

In other words, a gearbox and a torque converter perform exactly the same function. The former name is applied only to mechanical systems using gear wheels and the latter to hydraulic designs

SED BY DAIMLER

Used in conjunction with an epicyclic gearbox, the fluid flywheel has been incorporated in all British Daimler cars since the early 1920's. It big advantage is that it makes it impossible for the driver to stall the engine, yet provides a smooth, uninterrupted flow of power to the rear axle.

Torque converters had little automotive application, although a Swedis firm used it in conjunction with a direct drive and friction clutch in 1920.

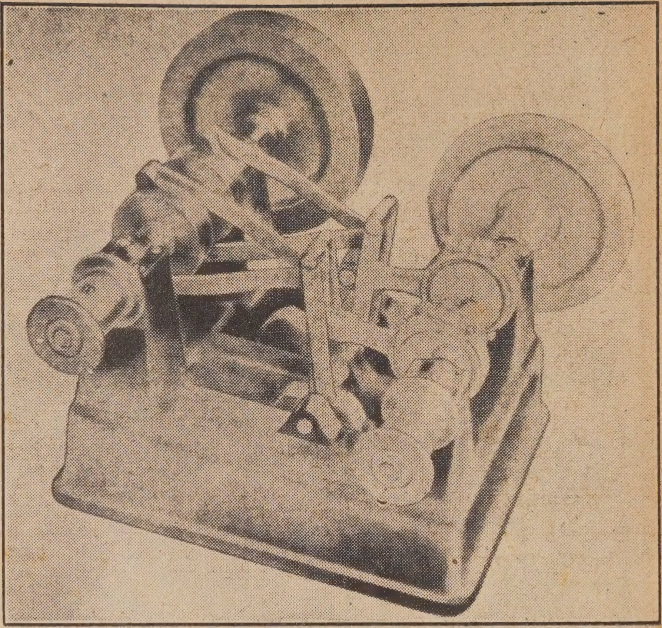
In the early 1930's various electrical and magnetic gearboxes were devised, including a design by an Australian engineer named Hayes, who built a unit later fitted to prewar Austin cars. The Hayes gearbox and others revolved around the basic principle of using magnetic power to actuate the gear selector forks of a conventional gearbox.

ust prior to World War II, the General Motors Corporation of America commenced a full scale investigation into the possibilities of automatic transmission. At first they experimented extensively with friction-type ideas, but eventually abandoned this form of design, as the metallurgical problems seemed insurmountable. However, in 1937, they introduced a full-torque passenger car transmission for the Oldsmobile.

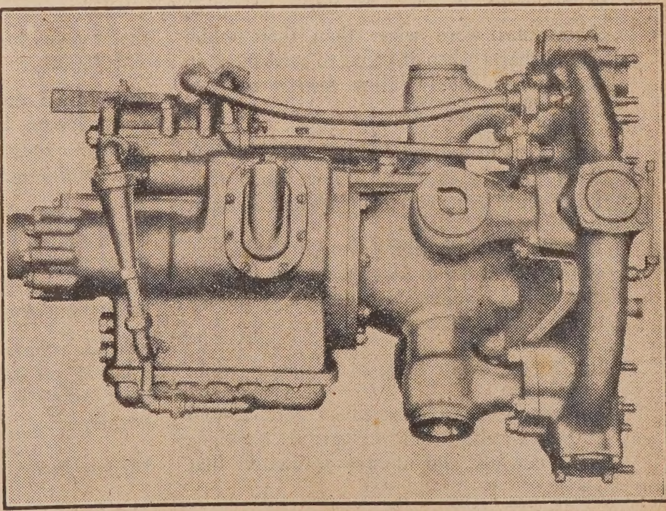
The new transmission did nothing for the car which could not be done by a normal gearbox—but it did it automatically. The driver was provided with a lever on the steering column which could be moved manually into four different positions—Reverse, Low, Drive and Park.

Reverse and Park speak for themselves, but the other two positions require some elaboration.

For normal driving purposes, Drive was selected. For abnormal purposes, Low provided extra power or acceleration, with proportionally higher engine speeds. In either gear position, nothing more was required of the driver than to use the accelerator and brake pedals.



French engineers attempted, without much success, to adapt the constantinesco Mass-Inertia drive, here shown in model form.



The Manley hydraulic automatic transmission, engineered in 1925. Weight and bulk spelt doom to this otherwise promising design.

Trail of wreckage left by the 1955 Maitland flood.

Aborigines were Wiser than the Whites

Aborigines were wiser than their white counterparts when it came to settlement in the Hunter River Valley district of New South Wales.

They kept to the surrounding hills — safe from the avalanche of water which they knew could bring sudden death and disaster.

Early in 1955, the worst flood in the history of the white man in Australia swept through the valley, causing privation and misery to thousands of people.

It also cut every form of communication.

More than 10,000 subscribers' services and 400 trunk lines and telegraph channels were cut off and it was estimated that the repair bill would total more than £500,000.

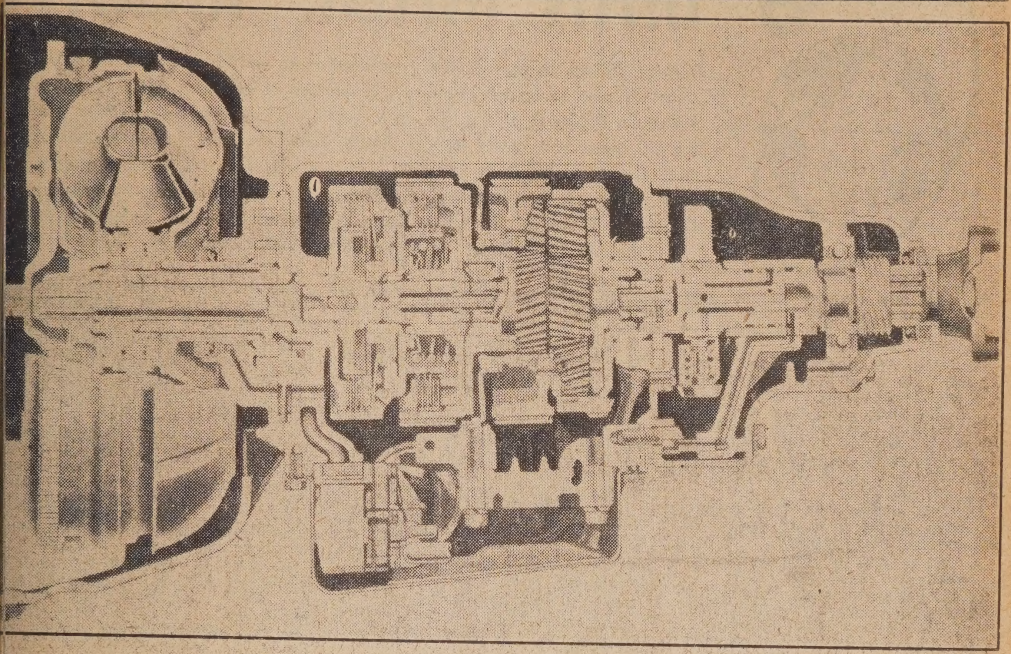
Safeguard for The Future. It was a costly lesson, but today science has found a way to reduce this sort of flood damage to a minimum.

A new resin* which permanently seals telephone terminal boxes in a solid waterproof block is being used by the Postmaster General's Department on its services throughout Australia.

SHELL scientists derived this resin from mineral oil to give communications the most effective waterproofing agent yet developed.

******Epikote Resin***

AUTOMATIC TRANSMISSION FOR 1956 STUDEBAKER



For those who like working out gear trains etc., here is a cross-sectional drawing of the "Flightmatic" transmission, incorporated in the 1956 Studebaker.

No clutch was provided and, ien Drive was engaged with the gine ticking over, there was no idency for the car to move for- rd. However, as the engine speed reased, the hydraulic clutch metimes called a fluid drive or hydraulic coupling) began to te" and the car moved off, ex- ly the same as though first gear d been selected in a normal car.

UTOMATIC CHANGE

When the engine speed reached pre-determined rpm. the gearbox omatically changed from first r to second. The driver did no- ng to precipitate the move, ugh conscious of it as the car used between gears, then surged ward.

n the same manner, third and top r was engaged at normal road eds.

When the car slowed down or engine began to labor on a hill, gearbox changed down auto- tically. If the driver used the kes to draw to a halt, it was necessary to "change down" nor slip the lever out of place. As engine speed decreased, the lraulic clutch lost its bite and car remained stationary until accelerator was pressed again.

The mechanics of the GM type gearbox was a complicated appli- on of several principles in them- es quite simple.

The gears used were not the el-cut gears used in conven- al gearboxes, but were an adap- on of the epicyclic train used the early model T Fords. In system, three gear wheels revolve about each other and inside a master "sun" gear. Gear ratios are altered by locking one or more of the "planet" gears within the "sun" gear.

A hydraulic system was used by GM to control the locking bands on the epicycle gear train and it was governed entirely by the load on the engine and its speed. Thus second gear could be engaged all day, provided that the driver did not accelerate beyond a certain engine speed range.

AUTOMATIC CLUTCH

The clutch system was also automatic. In the early GM transmission it consisted of a pair of multidisc clutches (similar to those now employed on motor cycles) which were opened and closed hydraulically whenever a locking band on the epicyclic gear train began to move.

The new automatic transmission was immensely popular, but it provided several mechanical headaches. First, there was a tendency for the hydraulic oil to leak, as it was continually under pressure. Secondly, the entire unit was basically only about 75 pc efficient and therefore the petrol mileage of the cars fitted with it dropped considerably. Thirdly, the change from ratio to ratio was not as smooth as might be desired.

So a year later GM introduced an improved version of this transmission, eliminating in part the earlier deficiencies. This design was fitted exclusively on the Buick and it was the last American automatic transmission which did not incorporate a torque converter of hydraulic design. The way had now been paved for the general invasion of all US manufacturers into the field of automatic transmission.

In 1939 GM introduced a new unit known as the "Hydromatic" which proved to be the most successful form of clutchless gear-changing ever devised. Over five-million of them (or variations thereon) have since been built and its design has provided the background to all American-type automatic transmissions.

In principle it was similar to the first GM unit, but the multidisc clutches were replaced with a hydraulic unit, similar to the fluid flywheel described earlier in this article. This hydraulic clutch (which operated automatically with the speed of the engine) was coupled to an epicyclic gearbox which was also automatically controlled by a hydraulic mechanism sensitive to the speed of the engine and its load.

MANY IMPROVEMENTS

Although it was a big step in the right direction, the Hydromatic gearbox also had failings in the matter of efficiency and smoothness. Consequently, there have been many variations on the design since, all endeavoring to improve the original theme.

On the subject of efficiency, it is interesting to note that a fluid flywheel (or hydraulic coupling as it is now called) is 95 pc efficient whereas the average torque converter is only 85 pc efficient. This explains to a certain extent who so many manu-

(Continued on Page 11)

MAN-MADE MOON

During 1957-58, as part of their contribution to the Geophysical Year, US scientists plan to launch into space a number of artificial satellites, which will circle the earth at the rate of 16 times per day. By arrangement with the US News and World Report, Radio, Television and Hobbies publishes this interview with three scientists who are leaders in the satellite project. They are Dr. A. T. Waterman, director of the Nation Science Foundation, Dr. A. H. Shapley, vice chairman, and Dr. A. F. Spilhaus, a member of the US Committee for the International Geophysical Year.

Q. Can you explain for us, just what is this so-called man-made satellite that the US is going to build?

A. Well, to put it briefly, the satellite is a small metal object that is going to be projected out about 200 or 300 miles into space and then sent spinning around the earth at speeds of around 18,000 miles an hour. It may be equipped with electronic instruments to report what it finds out there.

Q. This sounds like Buck Rogers or Jules Verne. Is it really the beginning of space travel?

A. We're not buying any space helmets!

Q. Isn't it a step in that direction?

A. This is a normal, small step. It seems like a terrific step, but it is just the next in an orderly series of experiments.

Journeys in space

Q. Couldn't this satellite lead to some of the things that people speculate about, such as a big landing platform, circling out in space, and eventually to flights to the moon or Mars?

A. It is possible—but we have to know more about a lot of things before we can say.

It's something like the launching of the first plane by the Wright brothers. The first thing was to find out if we could fly. You can talk about what else you are going to do later.

In talking about space flight, first you have to send up these experimental satellites and see what they can learn, find out what materials are best, what the conditions are that you will encounter out in space.

Q. What is the next step?

A. The next step might be to see if you can shoot one of these little satellites out and make it go round the moon.

Q. How about shooting people out into space?

A. We are not talking about people at all—yet. Before we start going outside the atmosphere ourselves, we'd better find out if this little satellite can do it.

Q. What would happen to a man out there in space?

A. He would be burned up by the heat or he would explode because of the vacuum.

Q. So you think it's still going to be quite a while before man can fly to the moon?

A. Yes, that's a long way off.

Q. The first reaction of a lot of people to this satellite announcement was a kind of fright. People seemed to think it had something to do with war. Is there really any reason to be frightened?

A. I should certainly think not.

Q. Could one of these satellites be converted into a weapon?

A. Hardly. This is completely different.

Q. But couldn't somebody build something that could travel around in space and then smash the earth?

A. How could they do it? Suppose you were figuring on the possibilities of this thing dropping bombs. Remember, it is going very fast—about five miles a second. Anything you try to drop out of it won't drop. It will keep going around, just like the satellite.

Q. Could this satellite be used for aerial photography?

A. There's no intention of making photographs.

Q. Could you do that later?

A. That depends on whether you could get a camera to televise pictures back. That would be a tough problem. If you couldn't do that, you would have to find some other way of getting pictures back to the earth without burning up from friction when their vehicle encountered the denser atmosphere.

If not military?

Q. Well, if this satellite is not a military weapon, what is its purpose?

A. The purpose is to find out much more than we know now about conditions outside the earth's atmosphere.

Q. What is it that you want to learn about outer space?

A. Oh, all sorts of things. We want to know more about cosmic rays, how the sun creates the ionosphere, about the stars, temperatures, densities—many things like that.

Q. Is it really important to our daily lives to know all that about space?

A. Oh, yes—of primary importance. I think the impact of all this basic data that we will obtain will be far greater than we can visualise at present. It will provide us basic, fundamental knowledge about the environment in which we live.

Q. What are likely to be the immediate advances from this study?

A. You just can't answer these questions sensibly about what is the immediate good. It's basic research. If you read history you find that basic scientific discoveries made 50 years ago, which then were considered utterly useless things, have become extremely important to ordinary living.

Q. Well, could you give us some examples of how this research might affect our daily life?

A. For one example, interruptions to our transatlantic radio communications are caused quite directly by radiations from the sun that disrupt the ionosphere—the electrified upper layer of the atmosphere.

The whole radio-communication industry is based on the use of the atmosphere. You get long-distance communication because the ionosphere has the property of reflecting radio waves. When the reflecting layer is disrupted, then long-distance communications won't work.

Or take meteorology, for example—weather forecasting. Each country has done some work in weather observation, but it is very spotty. We don't get anything at all from the whole Antarctic region, and we know that there are events occurring there that affect the weather of the whole world.

We have actually reached the stage where we can't improve our weather forecasting much until we can get world-wide information, including especially the polar regions.

Q. Then you think the studies planned with this satellite would improve our weather forecasting?

A. Yes. You see, there's the sun out there behaving like a boiling kettle that erupts every once in a while. If we knew what that is what it does to the outer air—once we can get the general pattern from all over the world—then this thing will become a rational pattern. It will lead ultimately to an improvement of our understanding of weather and climate, and will enable us eventually to make better forecasts. But one should emphasise that this is a long-term thing.

Control Nature?

Q. Will the studies made with this satellite enable us to control some of these forces of nature?

A. Well, in orderly science, yo have to measure before you ca understand, and you have to understand before you can predict, an you have to predict before you ca start to control.

Q. And what you are trying to d with this satellite is to measure, that it?

A. Yes. We hope to observe an measure phenomena that hav never been acurately measure before.

Q. But haven't we sent rockets u about as high as this satellite wi go, and haven't these rockets se

ck a lot of information about con- ions out there?

A. Yes. Our scientists have done very clever job in instrumenting ckets. They make observations d send radio signals down. But a ket is up there only momentarily. will give you information while goes up and down which tells you w things are at different layers a certain time, but it doesn't tell how these things change with ne, because it isn't there long ough. If you can get something there that will stay there, then u'll know how things are chang- .

Q. What will be done with all s information that is gathered by satellites? Will the US share with the rest of the world?

A. Yes. You see, the launching of satellite is being done as part the program of research set up the International Geophysical ar of 1957-58. This geophysical r is a period of time when scien- s all over the world will inves- ate their environment with all ts of geophysical appliances on a ge-scale, global basis. Forty ntries are involved in this. Most the countries of the world except ina are already participating in program.

formation?

Q. Will all of this information then exchanged?

A. All of this information will go a number of central clearing uses for the various fields of earch.

Q. Are the Russians taking part in geophysical year?

A. Yes.

Q. But haven't the Russians an- nced that they are planning to nch a satellite of their own?

A. They have announced in their ss that they are working on some h thing. But no word from the ssians has been received by the ernational Council of Scientific ons, which is sponsoring the physical year.

Q. You say this satellite will have direct military use, but will it us information that will be use- militarily as well as scientific- ?

A. Well, it would be of use mili- ly in so far as finding out con- ons in the upper air for air flight communications. The military badly need scientific informa- for all the things they want to Industry, commerce, almost rybody benefits from expansion cientific knowledge.

Q. Would it help with guided mis- s?

A. Yes, to the extent that guided siles travel through the atmos- re and it is necessary to know t they will encounter. Any ntific information ultimately is d, or can be used, for many dif- nt applications.

Q. What is this satellite going to into out there in space?

A. Absolute silence, for one thing. sky would be black, the stars ld be very bright, the sun would terrifically intense.

Q. What kind of temperature will nd?

A. The sun up there is terrifically but we don't know just how this satellite will get. It depends many things, for instance, color n important factor in the reflec- or absorption of the sun's rays.

Q. But doesn't it get colder as you get higher?

A. We've improved our idea of what the temperature is like out there. Before the rockets began this exploration, everyone thought that the temperature fell off as you reached a high point, and went to about 70 degrees below zero Fahrenheit. Now we know that's all wrong. The temperature goes down to a low point and then comes up high, and then goes through alternately cold and hot layers.

Q. Would the satellite be hot on the side toward the sun and cold on the other side?

A. The side toward the sun would certainly get terribly hot. Of course, you could make it rotate.

Q. Will there be any living thing put in this satellite — such as a mouse or an insect?

A. I would hardly say so, for the first time.

Q. But later on, maybe?

A. If it works, and we can develop it further, that would be one of the steps. Another thing would be putting in some germinating seed to see if the cosmic rays do things to them. But that involves getting those things back on earth again.

Q. Then, from what you say, aren't we still a long way from a space ship in which man could travel into outer space?

A. On this space-ship business, I could mention some things that I think may be interesting. Before anyone could contemplate going out into space there is the question of how people would react physically. For example, out there things have no weight. When you try to pour a glass of water, the water won't pour, it will just stay where it is. Nothing is anchored to anything, but just moves freely. Our bodies did not develop in that kind of environment. Blood circulation, swallowing, all our movements are regulated to the feeling of gravity.

Pressure cabin?

Q. Couldn't you use a pressurised cabin?

A. That wouldn't solve this situation. This is an absence of gravity. For instance, if this room were out on a space ship, you couldn't walk.

Q. What other problems would man encounter?

A. There are lots of problems. One of the problems in space travel is the density of these little meteorite swarms in outer space. You see, when these things hit the atmosphere they burn up. They are tiny little things as big as a pinhead.

Q. Are these the shooting stars we see?

A. Well, the brightest shooting stars may be larger. But there may be swarms of these things out there. Naturally, if you hit a swarm of these things at 18,000 miles an hour, it would be terrific.

Q. Do you have any assurance that these meteorites won't destroy the satellite?

A. Well, of course, if they are there in that density, that will be an extremely valuable piece of information in itself. But these are some of the terrific unknowns when you try to speculate about space travel.

Q. But you do know enough about the outer atmosphere to know that a lot of things are lacking that are certainly necessary to human life, don't you?

A. We certainly do.

Q. What has happened suddenly to make this satellite possible when it wasn't possible before.

A. Oh, it isn't at all happening suddenly. But one doesn't want to announce such a thing until one is certain it can be done.

Q. Has this satellite been designed yet?

A. I can say that we know we can do it. Rockets have already been up there. So it's only a matter of perfecting it.

Q. What will the satellite look like?

A. It will probably be round, to reduce friction.

How big?

Q. How big will it be?

A. It's anybody's guess. It will be about the size of a basketball, I guess.

Q. How much would it weigh?

A. That would depend upon what you wanted it to do. If it's light, it's easier to get up there. Of course, the heavier we can make it, the more instruments we can put in it. We will have to compromise at a weight that is feasible.

Q. What kind of instruments do you plan to put in it?

A. Instruments to make and report the various measurements that we want to take. As the instruments make their observations they will send the report back by radio signals.

Q. Can that be done now?

A. Actually, that is a very old thing. They've had them on weather balloons for many years, for instance.

Q. After you get this satellite up there, what keeps it moving in a circle around the earth?

A. There's nothing to stop it. Ordinarily, you see, things are stopped because of the friction of the air. But up at that height there is no air—or almost none. So, with no friction to slow it down, the satellite will just keep going.

Q. Indefinitely?

A. No, because there is still a little bit of air at that altitude. So the satellite will spiral in gradually. But we hope it will stay up for several days, at least.

Effect of gravity?

Q. What holds it on its course around the earth? Gravity?

A. Yes, gravity—the pull of the mass of the earth—is always pulling it down. But, like anything moving in a circle, centrifugal force is also pushing it out. At any given distance and speed, these things balance. What you do is balance the two forces, and then it goes in a circle, travelling constantly at the same distance from the centre of the earth—or almost. Probably its course will be slightly elliptical just like the earth's orbit around the sun.

Q. You say it will go 18,000 miles an hour. How did you figure that as the exact speed at which it should travel?

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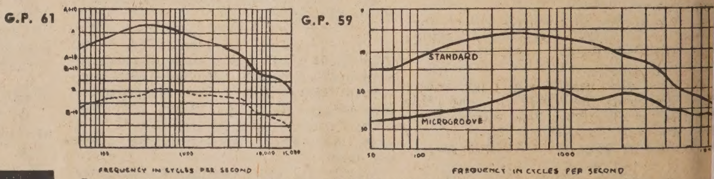

Response Curves of G.P. 61 (left) and G.P. 59 (right) turnover pick-ups fed into a 1 megohm loa

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A. There is a simple equation for this: g equals v squared over r. In this equation, g equals the gravitational acceleration, r equals the radius of the circle it travels, which is the distance from the centre of the earth, and v equals the satellite's velocity or speed We know g and r, so it's a simple mater of solving the equation to find v

Q. How will you get the satellite up to that height?

A. It already has been done. Remember those high-altitude rockets?

Q. How high have they gone?

A. The highest is 250 miles.

Q. Well, if you know the shape of his satellite, and you know the intruments that you want to put into it, and you already know how to get a rocket up 250 miles, what's the emaining problem?

A. This satellite not only has to e put up there, as far as the rockets have gone, but it then has to be tarted off in a new direction — aralleling the earth—at a speed of 8,000 miles an hour, or five miles second.

Q. How will you do this?

A. One way is to have the rocket o straight up 250 miles and then hoot the satellite out horizontally t may be more economical to have he rocket go up on some kind of a urved path and at the top accelerate while going in the right direction. We may have to find somehing in between. But that's the problem—to get the thing going up here in the right direction at this whopping speed so it will stay in he desired orbit.

Q. Do you know whether you can ttain such speed?

A. Yes, we think we can. That's why we made the announcement.

Q. How do you propel an object ut there in space?

A. Well, you have to have a tream of hot gases coming out behind which makes the thing go orward.

Q. You say you expect the satellite o come down after a few days. Will return to earth and be recovered?

A. No. You see, it will be travelng at such terrific speed that when it hits the earth's atmosphere, where there is friction, it will burn p—like a meteor.

Q. Why won't it burn up on the way up?

A. We won't allow it to go so fast n the way up. It attains that 18,000-mile speed after it leaves most of he atmosphere.

Q. The statement has been made hat we will be able to see this atellite as it circles the earth. How an we see something the size of basketball 200 or 300 miles away?

A. It depends upon how fast it is moving and how the sun hits it. Actually, of course, the statement hat it will be visible to the naked ye should be qualified. I think the est estimate is that, if you knew ust where it was, you might be ble to see it without a telescope, but he problem of finding just where it s is tremendous. But the astronmers are convinced that you will e able to see it quite easily with inoculars.

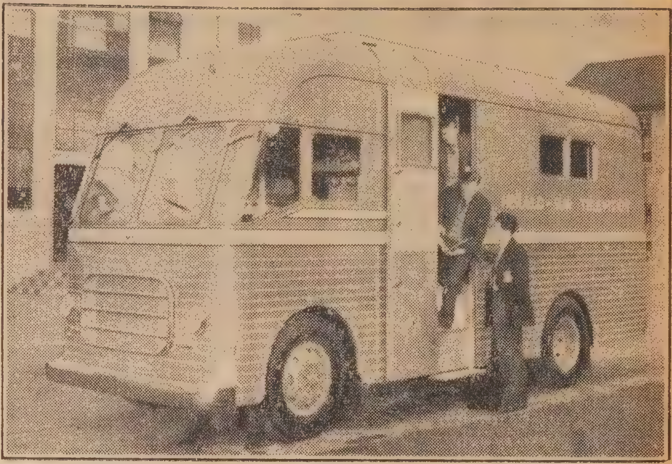
Q. The most you could expect to ee would be a tiny speck of light, wouldn't it?

A. That's about all.

Q. Would this satellite look like flying saucer to a man in an airlane?

A. I don't know. What does a lying saucer look like?

AUSTRALIAN OUTDOOR TV VANS



Destined ultimately to roam the streets of Melbourne, this outside television broadcast truck has been built by the Marconi company for Herald-Sun Television Ltd. Similar vehicles are being supplied to Amalgamated Television Services in Sydney and to the stations controlled by the Australian Broadcasting Commission.

CLUTCH, GEARS GIVE WAY TO OIL

(Continued from Page 7)

facturers are fitting more powerful engines — to make up for the power consumed by the automatic transmission.

Readers should not be confused by the references to hydraulic coupling and torque converters. Either unit can be used in an automatic transmission. As explained earlier, both are similar in construction but the latter alone can vary the torque output of the engine. Thus a torque converter coupled to a simple gear train will do the same job as a hydraulic coupling and a complicated gear train.

The Buick Dynaflow, produced in 1947, used a polyphase torque converter. It was the most efficient unit produced up till that time.

After the Dynaflow, American companies switched all their development energies to hydraulic torque converter mechanisms of the type originally invented by Hermann Fottinger. By 1949 there were seven different designs all based on the Dynaflow.

Later, Buicks brought out another "first". This time it was a variable pitch on the blades of the turbine. The idea is that at different rotational speeds, the angle of the blade affects the efficiency of the unit. Consequently a design which permitted different angles at varying speeds increased not only the economy of the transmission but also the acceleration of the car, since there is a direct link between the torque applied to the rear axle and the rate of acceleration.

If a driver requires more power for acceleration, he pushes the throttle hard down and the pitch of the blade is then instantly altered to cope with the new engine output.

More recently, there has been another dramatic improvement in automatic transmission systems. Both Packard and Chrysler have announced "push button" operation for their 1956 models. This means that a driver no longer has to select the appropriate position for the gear lever manually before the car starts from rest. A touch of a button provides him with "Park", "Low", "High", "Neutral" and "Drive" as required.

The mechanism which allows this has already been described in this magazine. It is both electrical and mechanical. The buttons are located on a console in front of the driver. When one is touched, an electric impulse is sent through a circuit to a servo motor. The motor then turns to rotate a range selector shaft. This shaft selects the appropriate starting gear (or drive, reverse or park), by moving the selector fork in the gearbox. Once the car is moving, the transmission operates in the same manner as a conventional automatic unit.

Detailed descriptions of the mechanics of an automatic transmission have not been given, for they vary considerably one from another. Basically, they consist of a fluid clutch which couples the engine power to the unit. The driven clutch plate then operates a hydraulic torque converter which operates in three distinct phases, each one of which is felt by the driver as if the gear had been changed. The phases are governed by the load on the engine and its speed.

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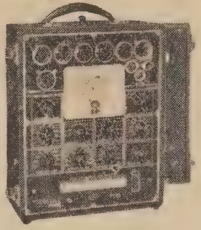
Model YOA. Gives dynamic on-the-beam performance, and new Vernier or fast drive dial makes for quicker and easier tuning. Has improved attenuation system and the dial is calibrated in spot frequencies for quick tuning over the main alignment points merely by changing the switch. Has continuous coverage from 30 megacycles to 1550 KC in overlapping bands. Write for free illustrated leaflet

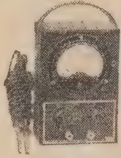


VALVE & CIRCUIT TESTER

Model T.S.T.: This versatile happy instrument operates from either 240 volts A.C. or a 6 volt battery. This makes it ideal for bench or portable use and it combines the functions of an up-to-date valve tester with a wide range circuit tester covering D.C. and A.C. volts as well as output volts, condenser checks, current and resistance Write for special bulletin.

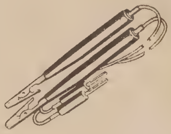
AC-DC MULTIMETER

Model MVA/2: This popular Multimeter is built to careful standards of accuracy and utilises 1 pc resistors throughout to ensure maximum efficiency. It covers AC-DC and output voltage ranges up to 1000 as well as D.C. current ranges up to 250 milliamperes. In addition there is a special 10 ampere D.C. range as well as four ranges of resistance up to 1 megohm.



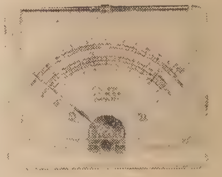
DC PORTABLE MULTIMETER

Model D.C.M.: This self-contained Multimeter is small and readily portable and is suitable for quick checking of circuits. It covers D.C. voltages up to 500 as well as D.C. current up to 250 milliamperes. Two ohms ranges are provided and it comes complete with test leads and instruction booklet.



TEST LEADS

Type B2: These popular test leads are of moulded high quality bakelite and come in red and black pair. Standard tip jack plugs terminate one end and red and black braided wire of extra flexibility is provided Push-on alligator clips allow the leads to be attached permanently to circuits. 10/6 per pair, plus 12½ pc Sales Tax



4-INCH SQUARE METER

Model W4: This all polystyrene meter pioneered by University Instruments provides the ultimate in appearance and accuracy. Available as an 0-1 milliammeter or any other type of standard range. It will enhance your equipment and yet will stand up to hard knocks as well as giving new beauty. This is one of the many meters in the University range.

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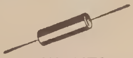
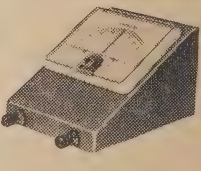


SHUNTS

A complete and comprehensive range of heavy duty shunts and light duty shunts are available. These vary from shunts in the microammeter range up to heavy duty shunts of thousands of amperes if necessary. Popular in radio testing are the light duty "R" type shunts, which are small and easy to use and are adequately protected in a moulded bakelite tube. The ends of the shunt are brought out to pigtails which allow quick and easy mounting. Normally these milliampere shunts are supplied to match 0-1 Milliammeters rated at 100 millivolts and are supplied in standard ranges of 5, 10, 25, 50, 100, 250, 500 and 1,000 milliamperes. Standard values for ohm ranges are also available. Price: 9/- each. including Sales Tax.



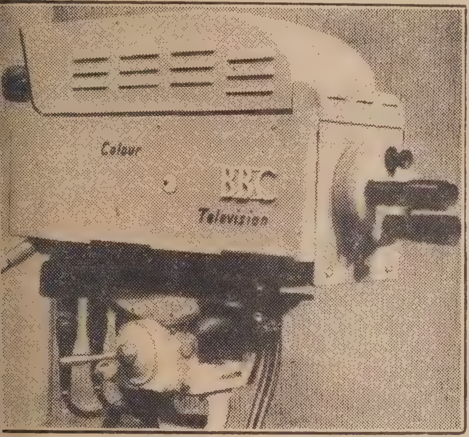
METER STANDS

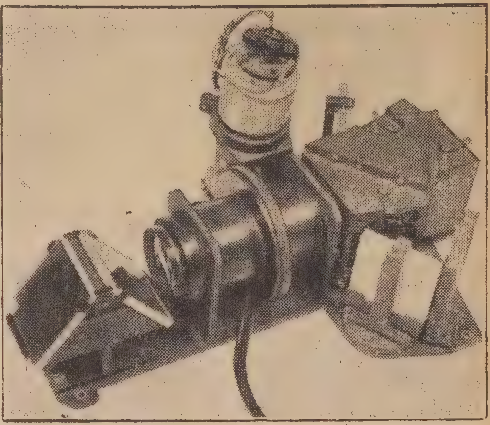
Model B20.

Illustrated herewith is the University Model W4 meter, mounted in a sloping front bench stand and fitted with terminals with non-removable tops. This stand is of steel finished in grey brocade and is ideally suited for testing laboratories, experimental setups technical colleges, schools and the like. The stand is ready stamped and drilled to accommodate either the W4, U4 or R4 meter. Model B20 stand can be supplied with or without meter and can be used as either a 60 degree sloping front stand or 30 degree sloping front stand.

LEARNING TRICKS OF COLOR TV

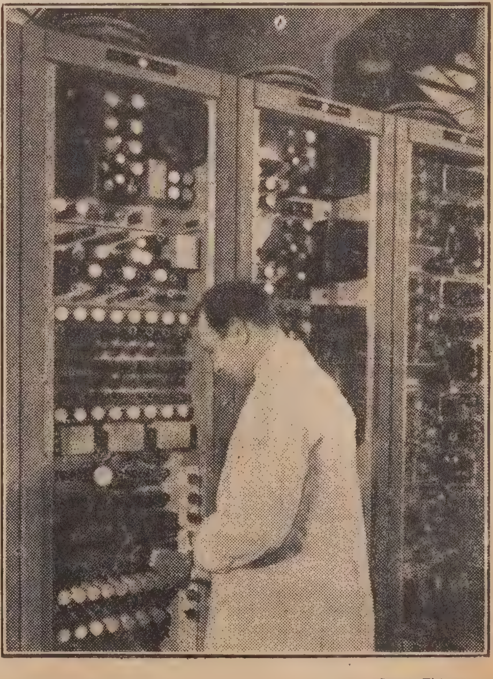
The BBC has recently taken delivery, for experi-
nental purposes, of a complete color television
camera chain from the manufacturers, Marconi's
Wireless Telegraph Co., Ltd. This is a fulfilment of
he first order the Corporation has given for color
elevision camera equipment and will provide an
ll-electronic compatible system to Anglicised
NTSC standards.





The BBC's first color television camera, shown on the left, is claimed to be easier to operate than existing black-and-white cameras. Turret and aperture are remotely controlled, while a twist-grip handle allows ready adjustment of the focus. The optical assembly of the camera is shown above. This includes the astigmatism correctors, the relay lens unit and the dichroic and color absorption filters, all of which contribute to the correct splitting of the light from the televised scene into three primary colors. The motor seen in the picture controls the iris setting.

The picture below shows another section of the equipment, the sychronising generator unit. The operator is shown changing a binary counter unit which is essential to its operator.



IE apparatus comprises a three-tube color camera,
a camera channel amplifier (including aperture com-
ation and gamma correctors) complete signal coding
pment for providing NTSC-type signals on British
line standards, together with all the accessories
h go to make a complete color camera channel.

In addition, black and white and tri-color monitors
a color-bar test generator have been supplied,
ther with a comprehensive amount of color test
pment.

Of particular interest is the color camera. This
rporates three 3in Image Orthicons of special manu-
ire. Each handles a primary color component fed
it by a system of dichroic mirrors and lenses, which
es to split the light received from the televised scene
the three primary colors.

Special features of the camera include a single
tely-operated four-lens turret, using standard
es, a remotely controlled iris, a high-quality view-
er to assist registration, and twist grip focus control.
vidual Image Orthicons can be changed in two or
minutes.

The new color camera is larger than the black-
white versions, but is actually easier to operate.
g completely balanced on a rolling tripod head.
h gives finger-tip operation of "pan" and "tilt".

In use, it is equally suitable for indoor or outdoor
es, the difference in color balance between artificial
natural lighting being compensated by the use of
ngle daylight correction filter.

The complete color camera chain is claimed to offer
three-color reproduction with greater inherent pos-
ties than any other known color reproducing system
ding color films, color printing or color dyeing
equipment has been given a 1000-hour operational
without change of camera tubes.

Marconi transmitters, extensively used by the BBC
already fully capable of handling color transmis-
, and it is understood that the BBC is to use the
camera chain for transmissions of a purely experi-
tal nature. Latest reports indicate that some trans-
sions will be integrated with regular programs.
vers will see them in black and white but BBC
neers will be able to study color reception as well
ompatability problems.

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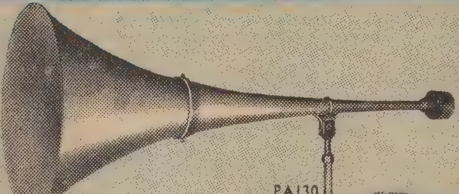
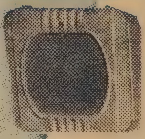
PA138

Standard reflex horn speaker for medium distance projection of speech and incidental music.



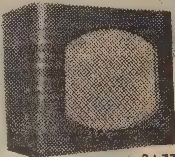
PA130

Standard exponential horn speaker for public address where distance projection of speech and incidental music is required.



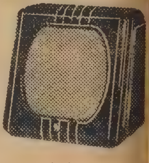
PA150/I

Attractive moulded ivory cabinet with 7" cone speaker and 600 ohm line transformer. Suitable for wall or desk mounting



PA77/12PS

Polished timber cabinet for wall or table mounting with 12" cone speaker and 600 ohm line transformer.

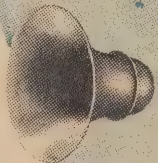


PA150/W

Moulded walnut speaker, similar to above. These models are also available with 600 ohm stepped faders.

RESLO DRIVE UNITS: SU10 & SU12

Exclusive features are the self-locating diaphragm and the concentrically interlocked magnet which together produce an undisplaceable mechanical assembly, proof against decentering.



PA108 & PA109

These flare baffles are for use with 7in and 12in permanent magnet cone speaker units and provide high conversion efficiency.

PA118

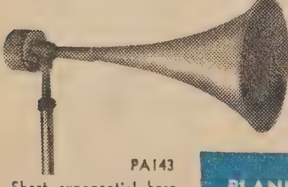
Pendant type, ceiling suspension, 360° diffusion speaker suitable for distribution of voice and music.

PA73

Ivory timber cabinet with 7in speaker for applications where a bi-directional characteristic is desired.

PA177

Flush, ceiling mount 360° diffusion reproducer with 7" cone speaker. Can be colour matched to suit any background.



PA143

Short exponential horn speaker for distance projection of speech only.

PA178

Surface mount reproducer similar to PA177, for use where flush fitting is not practicable.

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BIG DEMAND FOR BRITISH PLANES

Despite spirited overseas competition, British aviation exports reached the record figure of £66,189,978 last year, an increase of £10,080,000 over the preceding year's figure and £48,429 more than the previous record total in 1953.

By BRIAN McGILL (London Staff Correspondent)

THE December figure alone was £6,281,456, no less than £1,526,000 ore than for December, 1954.

During the year British aero-ines of one type or another were eported to all five continents.

The Viscount continued to sell like te "hot" plane it is. Seventeen ore were ordered by the United Sates—12 for Continental Airlines ad five by private corporations.

OTHER COUNTRIES

Other countries which ordered the Vscount were Canada, Pakistan, Illand, India, Australia, Burma, Nrway, New Zealand, Austria and Cba. In the dollar area alone te Viscount has earned Britain 110-illion so far—and the demand is stl continuing.

Another significant order last year as for six Britannias for El Al sael Airlines and Canadian Pacific Alines.

El Al ordered after a detailed sdy of the latest American rivals the Britannia—the Super Constel-on and the DC-7C.

Referring to this study, the Am-ecan magazine Aviation Age re-rts:

"The El Al study compared the erational and economic perform-ce of the Bristol Model 300 LR Btannia, the Lockheed model 19G Super Constellation and the Duglas DC-7B.

"While this study was being nted, detailed performance speci-itions for the DC-7C became avail-ale to the Israeli airline.

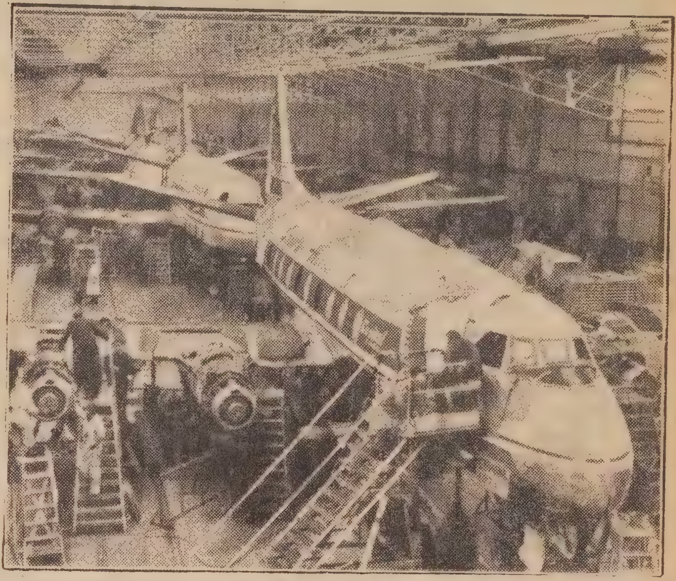
"When the DC-7C had been sub-ieted to the same analysis the other iee aircraft had received, the Bitannia still looked the best to E Al."

OUTSTANDING ORDERS

The present outstanding orders for Btish gas-turbine airliners amount about £stg140-million.

Another new British airliner to ordered abroad and "flight un-en" is the Handley Page "Herald". Astralia and Colombia have order-e 29 between them. This DC-3 rolacement is attracting great in-est in many countries. including t United States.

There are now 100 Herons in ser-ve in 19 countries and more than 5 of De Havilland's "Doves". The pularity of the Dove is quite re-rkable



One of the two Viscount production lines at the Hurn England factory of Vickers-Armstrong (Aircraft) Ltd. No. 1 line is entirely occupied with Viscounts for Capital Airlines of Washington DC. Capital has already taken delivery of nine of its total of 60 Viscounts. At the head of No. 2 line and nearly ready for delivery is the first of three Viscounts for Linea Aeropostal Venezo'a. Also on this line are Viscounts for Misrair (Egyptian Airlines), Trans Canada Airlines and Central African Airways.

A "Pocket-sized" electronic brain

WHEN one hears about an electronic brain, the imagination conjures up visions of thousands of vacuum tubes and water-cooled power supplies which occupy whole buildings Clearly such instruments cannot be used in aircraft. or other mobile equipment, only in stationary applications.

On the other hand, present day supersonic flying presents problems which can only be solved in sufficient time by electronic computers

A new all-transistor computer developed for the US Air Force by the Be laboratories occupies less than 3 cubic feet of space and needs only about 100 watts of power for its operation. It is thus ideally suited for installation in high-speed aircraft Besides, the innate ruggedness of the transistors makes these units almost impervious to shock and vibration, two of the main enemies of electronic equipment.

Called "Tradic", the instrument uses about 800 transistors and 11,000 germanium diodes.

Tradic is capable of performing 60,000 additions or subtractions, or 3000 multiplications or divisions per second. It can handle as many as 13 16-digit numbers at the same time.

Instructions are given to Tradic in the form of plug-in units, and the answers, mainly to trigonometric problems, are displayed on a CRO screen in the form of dots and geometrical patterns.

The instruction units are adjusted to the problems anticipated during the flight by means of cross-connecting leads. Each of the instruction units is then plugged into "Tradic" as required.

THE fastest land vehicle today is a rocket-propelled sled at the Edwards Air Force base in California, USA. It can travel 1100 miles per hour.

"Yes Sir, that was really nice" says Mr. House Fly, as he crawls from the dish. And why should we worry? He doesn't eat much!

MOST LIVE THINGS ARE INSECTS

We read so much about atoms and atom-bombs, H-bombs, space and stars and nebula, magnetic storms, sunspots and so on that we tend to forget that there are other worlds in our immediate vicinity which have a marked influence on our daily lives.

by Calvin Walters

THE insect world is one of these. It exists right at our feet, in our own back yard. On high mountains and thousands of feet up in the air millions of insects exist. They are found in hot mud springs and in Arctic regions. They live in caverns deep below the earth in perpetual darkness and in salt lakes and seas.

One of the easiest ways of "discovering" insects is to go on a picnic. Pack the basket and go into the country on a warm summer's day.

FINDING INSECTS

Select a shady spot under a spreading gum tree, unpack the basket, lay the table cloth on the ground, spread the food and settle down for a "quiet" lunch.

In some mysterious way a signal goes around all the insects in the shire and you are immediately invaded by hosts of every imaginable an unimaginable species and types. Millions of ants crawl into the jam—black ants, red ones and green ones. Yells from some members of the party herald the excursion of bull ants up trouser legs.

Flies and blowflies hang around the meat.

Gnats get into your ears and eyes and down your throat. Spiders fall from limbs and crawl over the butter. Moths fall into the milk, spreading a layer of iridescent fluff over the surface.

This dismal picture does not end here for, when this "quiet" lunch is over and you try to settle down on the rug to read the Sunday paper, you are dive-bombed by myriads of "mossies" and sandflies. Cicadas drone in your ear and you finish up in an argument on why insects were ever made!

Another good method of finding insects is to sit under a light on the veranda in the cool of the evening and try to read the paper. For this pastime you need some preparation.

You first spray around the place with a gallon of fly spray. Then rub exposed parts of the body with mosquito repellant which stings the skin and eyes. Next you burn some smelly substance in a saucer or make a fire of green gum leaves or cow manure in a kerosene tin, place your chair alongside it and open the paper.

After a while, you close it up, go inside, lie on the bed under a mosquito net and swelter under the heat of the bed lamp.

After experiencing all this, it will not come as a surprise to learn that it has been estimated that nine-tenths of all living things on the earth are insects.

You will no doubt reckon that you have got 'em all around your place.

Dr. Frank Lutz of the American Museum of Natural History has found over 1000 different members of the insect family in one back yard garden. He found that more than 500 species of insects live in apple trees.

20,000,000 PER SQ. MILE!

The United States Department of Agriculture estimated that the air over each square mile of the earth's surface contains some 20-million insects.

Mr. Edwin Way Teale, author of a remarkable book on insects says that if you set about to learn the names of 25 new insects each day, it would take you 60 years or more to memorise all those now catalogued by scientists. About six thousand new kinds are added to the list every year and the Bureau of Entomology of the U.S. Department of Agriculture estimates that the number of species may reach 10-million.

It can thus be seen that the insect world is of vital importance to us.

Consider for a moment some of the things which insects do.

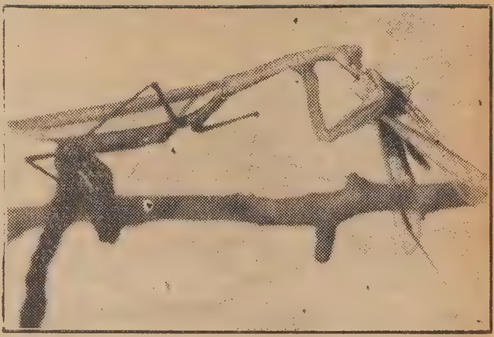
Flies and mosquitoes force us to manufacture and buy hundreds of thousands of pounds worth of wire gauze every year not to mention the mosquito netting, millions of gallons of fly spray and relevant equipment as well as all the repellant lotions.

PROFIT AND LOSS

Insects cause disease and consequent loss of wages and production. Vegetable-eating insects destroy about one-tenth of everything we grow. White ants destroy countless houses. Tomatoes, beans, potatoes, cotton crops are destroyed by weevils and beetles. Clothing is destroyed by moths and silverfish.

Fortunately there is a credit side to this picture for all the honey is produced by insects. Likewise al our silk and cochineal coloring. Tha important substance, shellac, is produced by insects. Over 60-millio pounds of shellac is used throughou the world every year. It take

Such a romantic little scene from the insect world—on the right,—Mr. Mantis and on the left his buxom spouse.



Alas, Mrs. Mantis has a consuming love for her husband.. What's more, the camera has caught her in the very act of consuming him!

50,000 insects over six months to roduce 1lb of shellac.

There are insects which live on ther insects. Most of these "cannial" insects are our friends and do o damage to our economics.

Scientists say that insects have een on the earth for millions of ears. They appear to have been e original inhabitants and seem have endured the ages unchanged. his is evidenced by the fact about ur-fifths of the fossil insects found eserved in various ways such as amber or limestone belong to rders which exist at the present me.

AN CHANGE

Income tax collectors must be a w species of insect as none of ese have been found. These old ssils are found in offices around pital cities.

One great difference between man d the insect, and that which has en responsible for the insects' pacity to endure through the ages, the latters' ability to make rapid anges to suit changing conditions.

Man tries to alter the conditions suit himself, whereas the insect anges himself to suit the contions in which he finds himself. or instance he turns to another nd of food when his usual source nourishment gives out. He can alter his way of life to condition himself to varying changes of climate.

Changes of temperature mean nothing to an insect. He can alter his internal arrangements in some way that enables himself to keep on keeping on, despite drastic changes of temperature.

Insects provide a most interesting study because of the countless variety of shapes and habits. Anyone who takes the trouble to provide himself with a magnifying glass or a cheap low power microscope can spend many fascinating hours watching the antics of these fascinating creatures. The material lies on any blade of grass or flower or tree limb anywhere.

It is a paradox that science seems to know far more about the world outside our own, than about the insect world. The strange habits and the mystery of their life cycles is still a mystery, even in this enlightened age. Yet among the insects we find those that weave and spin. There are builders and architects and carpenters. Shepherds and weather prophets exist there. Papermakers and musicians and soldiers are also among them.

One of my favorite insects is that little night songster, the ground cricket. His friendly chirping seems to add something like peace and comfort to the atmosphere, especially after depressing periods of constant rain.

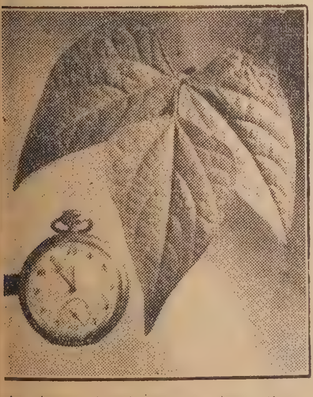
The method adopted by this creature to produce his song is intriguing. Up near the front of the forewings there are what look like ribs which are furnished with small teeth on the lower side. When the wings are rubbed together these teeth give a filing action which causes the wings to vibrate about 5000 times a second, thus producing sound waves at about this frequency. The sound has great penetrating power and certain species can be heard for almost a mile.

Strangely enough, only the males can sing. The females have no wings and are therefore incapable of producing sound. What a boon to mankind if the same applied to women!

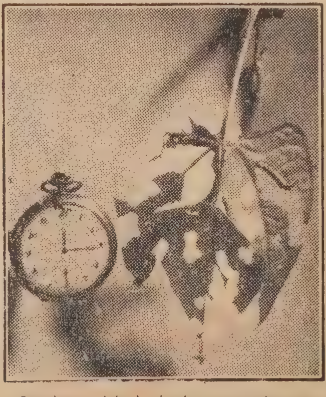
CHANGES ITS TUNE

There is a species of cricket found in America called the "snowy tree cricket". This is a remarkable "bird" in many ways, one thing being its habit of changing the tune according to temperature. Usually the sound is produced pitched about the note C.

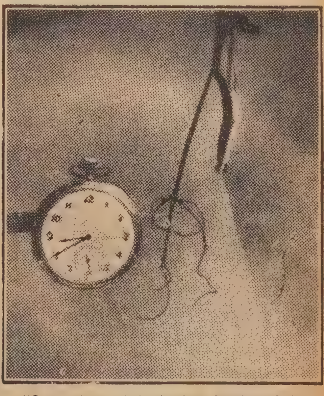
On warm nights the pitch rises to D. The number of notes produced per minute also varies according to the temperature and it has been found that, if the number of chirps per minute is divided by four and



At eleven o'clock, two or three tiny caterpillars find a spray of succulent bean leaves. They're feeling hungry.



By three o'clock they're not quite so hungry, but they haven't yet run out of appetite—not by a long shot.



"Say, where did all that food go? I'm still hungry! Let's go somewhere else and rustle up a feed of bean leaves."

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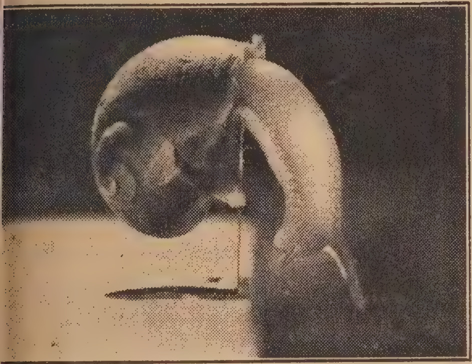
n 40 added, the result is approxi- tely the temperature in degree renheit.

 popular insect with children is noisy cicada which fills the air h a tremendous volume of cous sound in the summer time. eat times are had by all climbing es looking for "yellow mundies", een grocers" and so forth.

These are an amazing insect to dy, as they are large enough to tch them coming into existence, to speak.

TRY THIS NEXT TIME YOU SHAVE

The snail may seem a pretty dumb creature but he doesn't believe in walking right round an obstruction when he can go over the top



Up and over, with his "throat" pivoting on the razor edge. Snails would presumabily have to resort to other means of committing suicide!

The eggs are laid by the female aturally) in the bark of trees.

Tiny creatures hatch out from the gs and fall to the ground. They their way into the ground somenes for a distance of 2ft until they counter a small rootlet. Here the ung insect hollows out a cavern, gs its beak into the root and lives the sap of the plant. As it grows shifts its location.

During its growth underground, e cicada moults several times and quires a larger skeleton. Inci- ntally, the skeleton of all insects on the outside. This is the man- r of growth of insects. From time time the insect sheds the outside eleton and grows a newer and ore roomy one. At each shedding e insect therefore grows larger.

NDERGROUND MOVEMENT"

Some species of cicada are under- ound for as long as 17 years fore they are ready to come to the rface.

When matured, the cicada starts to me to the surface. At this stage is called a nymph. It usually mes out close to where it entered e ground and proceeds to climb a nvenient tree or post.

Encased in its hard outer shell it taches itself to the post or limb. ere it goes through a curious un- xplained series of movements. It st rubs the forelegs together in a anner suggesting that it says to elf "well, here goes"! It then rokes its head and antennae and assages its abdomen with its hind gs.

The nymph then builds up a pres- re inside the shell by a series of ave-like motions which eventually lits the shell down the back.

This may take several minutes d the cicada comes out head first, ries out while the wings unfold d it is ready to add its quota of noise to the chorus.

Near the base of the wings are cavities which contain a tightly stretched membrane with the convex side outwards. Powerful muscles vibrate these membranes very rapidly like a drum. The cavities have flaps which enable the cicada to increase or decrease the volume of sound by opening or closing the opening to the cavities.

This appears to be for the purpose of confusing the enemy. On the approach of such enemy the cicada can reduce the volume to give the impression that it is a long way off, with the hope that the enemy will cease looking.

The ordinary plant aphis is an outstanding example of the fantastic capacity of some insects to multiply and the utter impossibility of ever eliminating insects from our life.

These insects produce young far beyond our capacity to destroy them. It has been calculated that, if the descendants of an aphis were allowed to multiply without hindrance through a single season, the total weight would be over 800-millions tons. And an aphis weighs only a tiny fraction of an ounce.

UNUSUAL PROCESS

This amazing fecundity comes about in this way. Female aphides give birth to offspring without the intervention of a male. Her life therefore must be somewhat uninteresting. In addition to this, all the offspring during the summer months are females which in turn produce more females and so on.

It is only during the autumn that the males appear and mate with the true females which lay the eggs to hatch out into female producing females.

This capacity of the unmated female to produce offspring is called "parthogenesis". It is still a scientific mystery.

Another mystery about the aphides is the fact that, although they are born without wings, at times of over-population of a specific plant, winged aphides appear. These fly to other plants and establish new communities of aphis. These new colonies are wingless.

When the food supply of this new colony begins to run out winged females appear once more and repeat the performance. How this happens no one knows.

In this way the aphis spreads over the garden and indeed the whole world.

Considering that an aphis may produce as manv as six female producing aphides in one day gives some idea of the fantastic numbers which would be produced in a single summer season. If you watch the aphides on the rose bushes in the garden you can almost see them multiplying.

The British biologist Huxley says that if the offspring of an aphis could multiply unhindered for a single season the resulting progeny would cover the entire earth with a layer of aphides.

ALWAYS WITH US

With the above example to assist it can be seen that insects are likely to be with us until the end of all things (except insects). As Dr. W. J. Holland ended his book on moths so will I end this discussion with his words.

"When the moon shall have faded out of the sky, and the sun shall shine at noonday with a dull cherry red, and the seas shall be frozen over, and the ice cap shall have crept downward toward the equator from either pole, and no keel shall cut the waters, nor wheels turn the mills; when all cities shall have long been dead and crumbled into dust, and all life shall be on the very last verge of extinction on this globe; then on a bit of Lichen growing on the bald rocks beside the eternal snows of Panama shall be seated a tiny insect, preening its antennae in the glow of the worn-out sun, representing the sole survival of animal life on our earth, a melancholy 'bug'."

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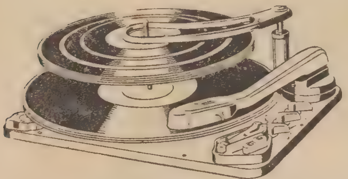

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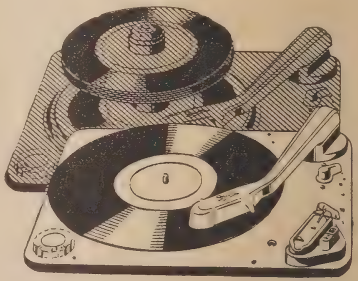

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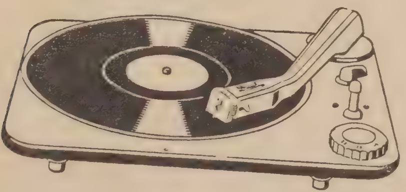

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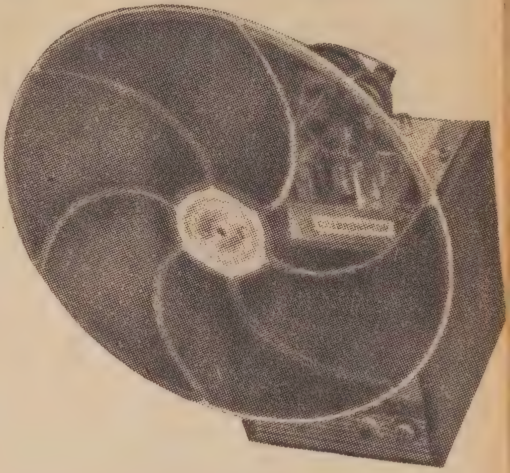
Technical Review

INGENIOUS ADAPTOR GIVES LOW COST COLOR TV

For a really intriguing and unusual device it would be hard to beat that described in a recent copy of Radio-Electronics. In what at first glance appears to be a backward step, it successfully converts a standard color TV signal to one requiring the now virtually extinct rotating color wheel.



The Colordaptor with one segment of the color wheel removed to show the decoder chassis. Decoder uses standard color TV technique to separate color signals but converts these to field sequential system. Note drive motor at rear of chassis.

HOWEVER, the idea is not as silly as it seems. As the article points out, tri-color pictures are expensive —and, by all accounts, hard to get —while a lot of additional components are also required to make up a completely electronic color receiver.

For the experimenter of limited means, but who is prepared to build a suitable adaptor, the new scheme means that he can enjoy color transmissions which he would otherwise be denied.

Naturally there would be some limitations in such a system, although the original article does not emphasise them. All field sequential systems suffer from color fringe on rapidly moving objects, while limited picture size (due to color wheel size limitation) and reduced brilliance would be other problems.

INGENIOUS SCHEME

Nevertheless the scheme is an ingenious one and it could enjoy some popularity, at least until the cost of color receivers is reduced.

Known as the "Colordaptor system", it is being marketed in kit form for home construction or may be built by more advanced workers from published circuits using standard receiver components. The circuit is claimed to be relatively simple (it uses only nine valves!), easy to adjust, and suitable for permanent connection to the existing receiver.

Heart of the system is the decoder, which uses six of the nine valves. Its purpose is to convert the incoming signal from the now standard NTSC dot sequential system to a field sequential system as required for color wheel presentation.

This signal is supplied to the black and white picture tube and, when viewed through the rotating color wheel, a full color picture results.

The first job the decoder has to do is extract the color information from the video signal, using much the same technique as employed in standard color receivers, i.e., comparing the phase of the incoming color signal with that of a local signal, crystal generated and kept in correct phase by means of reference signals transmitted during part of each horizontal flyback period.

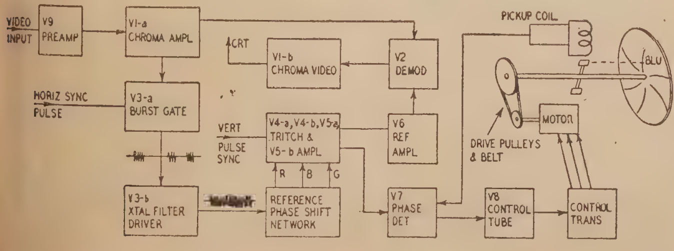
Conversion to a field sequential system is achieved by means of a "tritch", a tri-stable electronic switch which "rotates" through three separate positions 20 times every second. In each position it switches either red, blue, or green impulses only to the picture tube.

THREE "POSITIONS"

It is triggered into each of these positions by the vertical synchronising pulse and is thus automatically synchronised with the color wheel, since this is also synchronised by the picture rate. Thus, assuming correct phasing, the red filter will be in front of the tube when red information is being displayed, the blue filter for blue information, and so on.

The color wheel is driven by a small electric motor (something between 1/100 and 1/30 horsepower) and is synchronised by means of iron pole pieces mounted on the color wheel shaft and a synchroniser pickup coil.

Impulses generated in the pickup coil are compared with the normal sync pulses and, when they appear earlier than the latter, are used to reduce the speed of the motor. The color wheel normally runs slightly faster than required. (Radio Electronics, January, 1956.)



Block diagram of the decoder. Note "tritch" which converts NTSC signal to field sequential system

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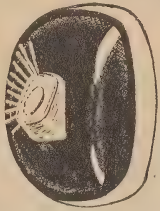

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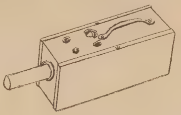

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NOTE. An amplifier for a record player using 2-OC71 and 1-OC72 will give ample volume from ONE 6 volt battery. Full details in book above.

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JANUARY ISSUE

1 VT Voltmeter (p. 32)
Multi-Band Receiver (p. 46)
4 Small High Quality Amplifier (p. 60)

FEBRUARY ISSUE

J Basic D/W Set (p. 46)
Baby Mantel Set (p. 32)
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EVERYTHING FOR THE RADIO AND ELECTRICAL EXPERIMENTER

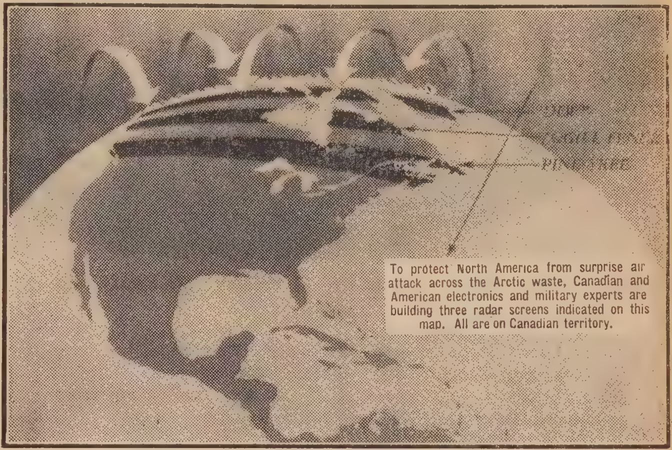
TRIPLE RADAR DEFENCE NETS GUARDS CANADA-U.S.A.

Across a vast northern territory stretching almost three thousand miles from east to west military and electronic experts of the United States and Canada are building the most comprehensive defence system in history.

UNLIKE the Chinese Wall of ancient history or the Maginot or Siegfried Lines which proved almost completely ineffectual in World War II, this North American defence system offers no physical obstruction to potential invaders.

Ranging across the cold, barren and rugged territories of the Canadian north, it consists of an elaborate series of early warning radar tations which would flash back to defence headquarters the reports of an approaching enemy.

Thanks to such early warning, defence units would be alerted, and defending planes would be in the air to meet the aerial invaders beore they reached targets of industrial and strategic importance.



To protect North America from surprise air attack across the Arctic waste, Canadian and American electronics and military experts are building three radar screens indicated on this map. All are on Canadian territory.

PARTNERS IN DEFENCE

Defence preparations in this era of terrible weapons, swift communications, and surprise attack have become highly scientific, extremely ostly, and continental rather than purely national in scope. Hence the United States and Canada are working as close partners in the protection of a continent which they both share.

In the overall radar project, involving three defence lines, the costs, design and development of equipment and the manning of the warning stations are being shared by the two countries on a mutually agreed basis.

Among the factors involved in the sharing are the relative sizes, populations, and wealth of the two nations, plus the location on Canadian territory of a defence system also essential to the protection of the United States.

The first of the three defence lines, called "Pinetree", is the closest to the Canadian-United States border. It is located relatively close to the thickly populated strip of Canada adjacent to the United States —although in the vast distances of Canada "relatively close" is still measured in hundreds of miles.

Far to the north, in and near the Canadian Arctic regions, the United States is building the DEW line, North America's first line of defence against approaching aircraft. This is an exclusive US project, but approximately midway between DEW and Pinetree, near the fifty-fifth parallel, work is progressing on the third line—the "Mid-Canada", commonly known as the "McGill Fence".

NEW CONCEPTS

The equipment being installed in the "Mid-Canada" line involves new concepts of radar defence and has been developed by the RCA Victor Co. of Canada working with scientists of the Canadian Defence Research Board and the Eaton Electronics Laboratory of McGill University in Montreal. This group produced the first experimental and prototype equipment, and installed and operated extensive experimental systems both in the populated areas of Canada and in the far north.

Following these test operations, in which the value of the new system has been thoroughly proven, engineers began active work on the overall planning of the "Mid-Canada". (Radio Age, October, 1956.)

POCKET SIZE TWO-WAY RADIO

Dick Tracy, with his fabulous two way wrist radio, has been out on his own for a long time but it looks as though fact is catching up with him at last. The latest effort is a vest pocket size transceiver intended, initially, for use by US Army Signals.

DEVELOPED by RCA and now being tested under field conditions, the new set is claimed to be the smallest two-way FM radio ever uilt. It is intended for use as a possible communication device for quads and other small tactical miliary groups in the field.

The tiny transistorised instrument s small enough to be carried in a hirt pocket, yet powerful enough or two-way communication over a uarter mile range.

Brief details of the instrument are as follows:

Built around 12 transistors and one conventional valve, the pocket ize is a new design approach to wo-way portable equipment. The ltra-miniature unit was made possible by the use of transistors and ew electronic circuitry which preent at the same time advantages of igh stability, long battery life, and uggedness. In addition, the equipment is readily adaptable to fully utomatic operation.

The transceiver incorporates two simple controls for two-way communication—a push to talk button and a combination on-off switch and volume control. No tuning or adjustment is required and the built-in microphone-earphone provides clearly audible reception when held several inches from the ear.

The tiny transceiver in action. Weighing less than 1lb, it is strapped to the soldier's helment.

The receiving unit itself is small enough to store in a vest pocket. Produced as an independent unit for one-way communication, it could be used to link a platoon or squad leader with individual soldiers. The complete transistorised transceiver weighs only 15oz and is about the size of a small tobacco tin. (Radio Age, October, 1955).

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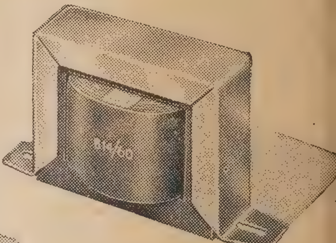
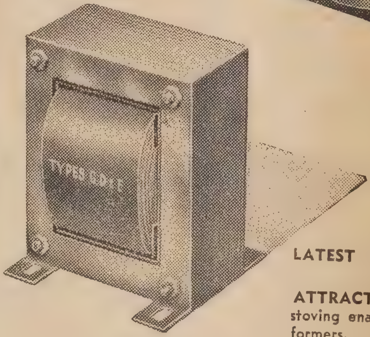


RANGE Available in all types from 50 to 250 mA. Miniature types A12/50, B14/60 available.

COIL is impregnated scientifically with special varnish and baked to resist humidity.

FOUR COOLING LOUVRES in the covers permit up draughts of cool air past winding, ensuring lower working temperatures.

UNIQUE LEAD ANCHORING inside the core prevents the leads being pulled out.



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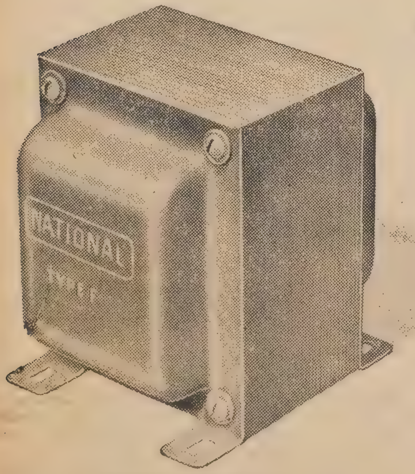

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TYPE	Inductance in Henries	mA	D.C. Resistanc
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C.20/60	20	60	500
D.30/60	30	60	600
C.15/80	15	80	430
E.20/80	20	80	300
E.30/80	30	80	380
F.15/100	15	100	300
F.15/125	15	125	250
F.15/150	15	150	200
F.12/175	12	175	160
F.12/200	12	200	125
F.12/250	12	250	133

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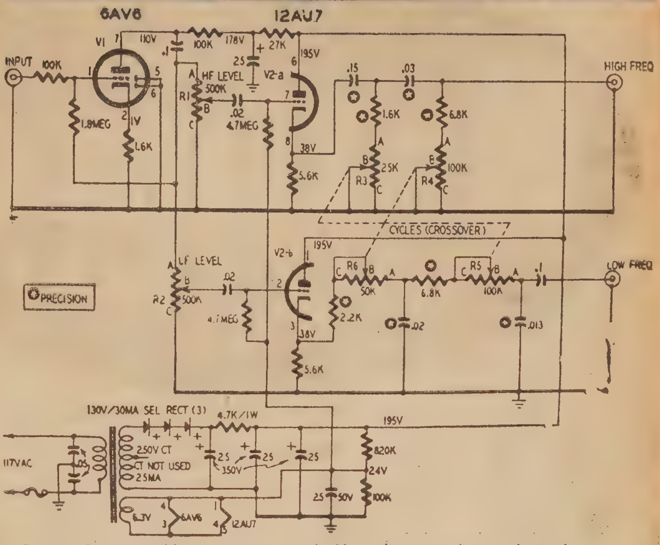
A NATIONAL PRODUCT FOR A NATION'S NEEDS

VARIABLE CROSSOVER UNIT FOR TWIN AMPLIFIERS

Those audio enthusiasts who like the idea of multiple speakers but who doubt their ability to construct a satisfactory crossover network, may care to try the following approach. A crossover network is used after the preamplifier and ahead of two main amplifiers, one for each channel.



Circuit of the variable crossover network. Note the ganged controls in the crossover circuit and individual gain controls in each channel. All components are standard.

ALTHOUGH more complex, there are many enthusiasts who would like to try this approach and the unit described here appears to be a good example of such a system. Known overseas under the trade name of the "Van-Amp" it is sold either complete or in kit form. Local enthusiasts may care to try their hand at their own version from the published circuit.

The crossover frequency is continuously variable from 90 to 1100 cps, while the rate of cut off of each channel is 12 db per octave, an improvement over many simpler systems where only 6 db per octave is possible.

Individual level controls permit the gains of the two channels to be varied for correct balance as dictated by variations in speaker sensitivity, &c. This, and the variable crossover frequency is particularly valuable where it is likely that a new speaker (or speakers) will be used at a later date and which may not match a conventional crossover system.

(Come to think of it, did you ever know an audio enthusiast who WASN'T contemplating buying a new and better speaker just as soon as he could raise the wind?)

Output from the crossover network is at a relatively low impedance due to the use of cathode followers and quite long leads may be used (10ft or so) without treble loss. It is also claimed that the use of separate main amplifiers may help to reduce IM distortion. The unit has an overall gain of about eight times.

CIRCUIT DETAILS

A 6AV6 (V1) is the input stage feeding the high and low frequency channels. The output signals appears across high and low frequency level controls R1 and R2 in parallel. The arms of these controls feed the grids of cathode followers V2a and V2b.

The frequencies are separated by variable high and low pass filters between the cathode followers and the output terminals. The cut-off frequency for the high pass filter is controlled by R3 and R4 and the frequency of the low pass filter by R5 and R6. The controls are ganged and wired so that cut-off points of the filters increase and decrease together.

Shifting the crossover point may often make it possible to avoid an obvious peak or loss of performance in one or other of the speakers and makes the system very versatile.

Local enthusiasts may have to modify the power supply slightly to accommodate local components but it should not be difficult to evolve something which will give voltages approximating those quoted. Main change will be the use of a valve rectifier in place of the metal rectifier. (Radio Electronics, February, 1956.)

* * *

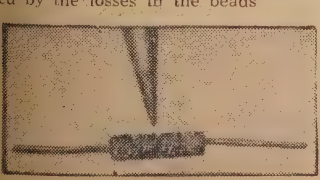
FERROXCUBE BEADS TAME RF

An ingenious method of restricting the magnetic field around wires carrying HF signals has recently been announced by the Ferroxcube Corporation. It takes the form of Ferroxcube beads which may be strung on the offending wires.

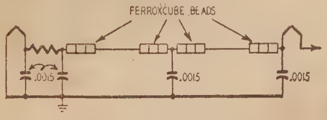
SUPPLY leads and audio leads are the most common offenders, since it is generally found that they are carrying a certain amount of HF signal as well. Decoupling restricts this to some extent but is not always completely effective, particularly at the higher frequencies where the decoupling capacitance can easily produce parasitic resonance.

Ferroxcube's solution is to feed shielding beads on to supply leads that may cause trouble. The permeability of these leads is high. As a result the inductance of the lead is greatly increased, so much so that the lead now functions as a choke for high frequency signals.

Furthermore high losses take place in the beads at frequencies exceeding 500 Kc. Any RF or IF oscillations set up in the leads despite this choke action will be severely damped by the losses in the beads



Showing the Ferroxcube beads strung on a wire. Note the small size as compared to the point of a pencil.



Showing how Ferroxcube beads are used to minimise coupling through a common heater circuit. Note extra bypasses.

An example of how the beads may be used practically is illustrated in the accompanying circuit. This shows part of a series heater line in an AM-FM receiver using a three-section decoupling network.

The resistor in the first section acts as a voltage dropping as well as a filter unit. The two other sections each consists of a piece of hook-up wire with three beads positioned at either end. The leads are by-passed to chassis by the .0015 mfd capacitors. Thus the choke action of the beads is supplemented by the filtering action of the capacitors. Feedback by the way of the filament line is thus suppressed.

The beads are likely to be used for decoupling supply leads from the power supply to the front end. These are long leads that often pick up IF signals. The more beads used the greater the choking and damping effect.

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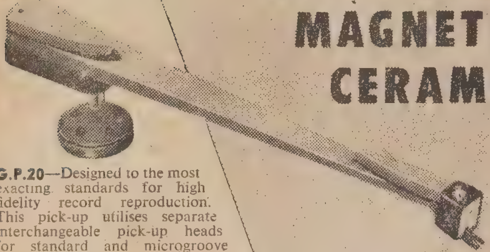
CRYSTAL MAGNETIC CERAMIC



G.P.20—Designed to the most exacting standards for high fidelity record reproduction. This pick-up utilises separate interchangeable pick-up heads for standard and microgroove recordings. **PRICE, £7/19/6.**

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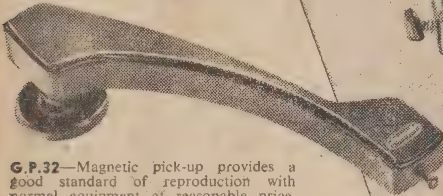
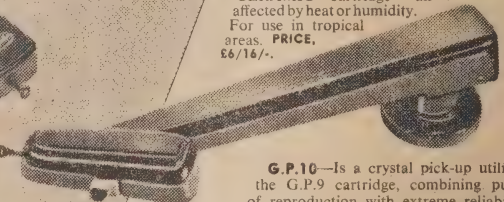
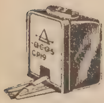
G.P.60—Incorporates the latest type CERAMIC cartridge — unaffected by heat or humidity. For use in tropical areas. **PRICE, £6/16/-.**



G.P.32—Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage—½ volt at 1,000 c.p.s. **PRICE, £2/12/6.**



G.P.10—Is a crystal pick-up utilising the G.P.9 cartridge, combining purity of reproduction with extreme reliability. Resonance-free response from 50/8,000 c.p.s. Output, 1.5V. at 1,000 c.p.s. **PRICE, £3/12/6.**



H.G.P.39 CARTRIDGE—Designed to meet the most exacting requirements of modern recordings—low element mass and very high compliance enables the heaviest modulation possible to be traced with a minimum of record wear. Both standard and L.P. heads available. **PRICE, £3/12/6.**

G.P.19 CARTRIDGE—Designed for standard and microgroove recordings which will trace the groove of any recording and will reproduce any frequency that may be engraved on the record. Separate interchangeable heads for standard or L.P. **PRICE, £2/18/6**

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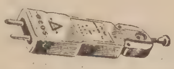
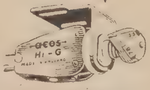
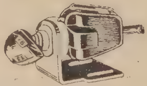


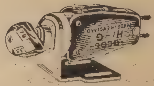
G.P.9 CARTRIDGE—Now famous as the cartridge with the unbreakable crystal. Takes standard steel or fibre needles for 78 r.p.m. records. **PRICE, £1/11/6.**



G.P.59 CARTRIDGE—A HIGH OUTPUT cartridge suitable for reproducing standard and microgroove records through low-gain amplifiers. **PRICE, £2/3/-.**



G.P.61 CARTRIDGE—A CERAMIC cartridge that will withstand the rigours of a tropical climate and is, at the same time, very robust. **PRICE, £3/19/6.**



H.G.P.37 CARTRIDGE—A turnover cartridge with cantilever stylus that utilises a new method of crystal drive, a bisectional control element that achieves independent characteristics for standard and microgroove. **PRICE, £2/18/6.**

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RADIOACTIVE TRACERS

In this article, continued from last month, Dr. A. D. Merriman explains further uses to which radioactive tracers are being put in Britain. He mentions their use in tracing cancerous tissue and in helping to keep clear crude-oil pipe lines.

Radioactive iodine is rapidly aken up, and in comparatively large uantities by the thyroid gland, hich absorbs about five hundred mes as much as other tissue. It is, n fact, possible to classify the dif- erent diseases of the gland by the ntake of iodine. In malignant dis- ase the cells lose their capacity to bsorb iodine so that it does not ppear possible to treat cancer of e gland by the administration of adioactive iodine. The normal pro- edure is the removal of the gland.

XCESS THYROID

In one such case it is recorded hat some years after the operation he patient began to lose weight and n examination revealed that he was uffering from excess of thyroid ctivity. Somewhere in the patient's ody cancerous thyroid tissue had eappeared, but the problem was ow to locate it.

A tiny amount of radioactive odine was injected into the patient. fter a short interval the surface f the patient's body was carefully xplored with a Geiger counter. The ell-tale ticks came slowly at first, hen faster and faster. In a very hort time the counter had dis- overed the location of the radio- ctive element and with it the ugitive cancerous tissue.

One of the simplest applications f radioactive material, is to use it o indicate the position of some bject which is not easily accessible r which is buried under other aterial.

Frequently oil has to be trans- orted by pipe line over long dis- ances, from the wells to the efineries or the nearest port for oading into tankers. These pipes end to become choked by deposits hich settle out from the crude oil. ad welds sometimes encourage the ncrustations. So from time to time leaning operations must be car- ed out.

NTERNAL SCRAPERS

This is done by scraping, the rapers being pushed along the ipes by compressed water or oil. here the scraper jams it is neces- ary to break ground and open up e pipe for repair or replacement.

In the past many holes had to e dug and the pipes broken at any points in the effort to find the raper. Now the uncertainty in cating the scraper has been elimin- ed, because it carries with it a ellet of radioactive cobalt. Together they are pushed along at about walking pace so that the progress of the radioactive material can be followed with the help of a Geiger counter. Where the scraper becomes stuck can be known with certainty.

A hole is then dug in the right place and a new length of pipe or repairs to the existing one can be carried out without wastage of time.

As tracer atoms give out energy — often in the form of beta or gamma radiation—they gradually change to stable atoms. The time taken for the activity to be reduced by one half is called the "half life". The expectation of life of radioactive atoms is governed by a very simple law, namely, "the fraction of the total number of atoms that break down per second is constant".

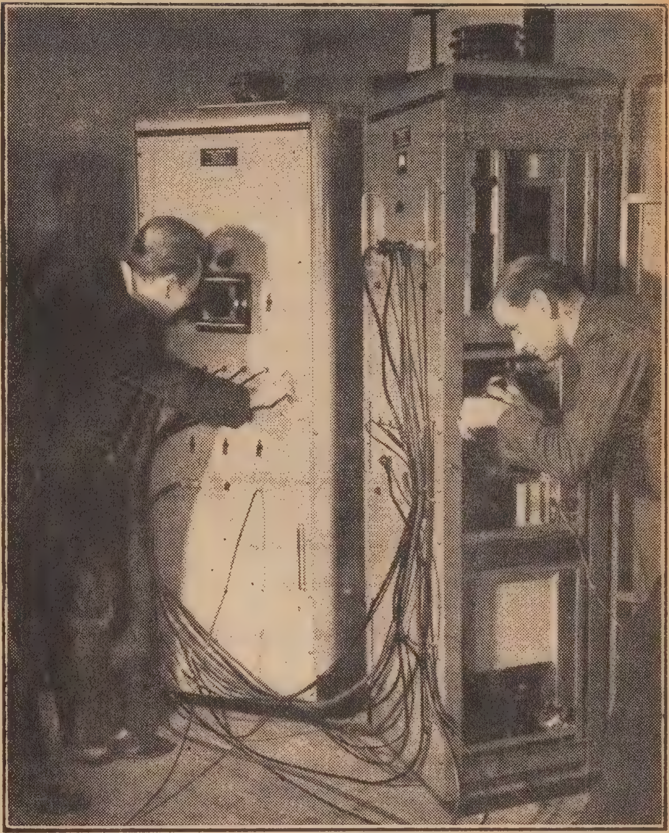
Now, if this fraction be turned upside down there is obtained a figure called the "average life". The average life is very nearly equal to one and half times the half-life. Usually substances with short half-lives show greater activity than those with long half-lives.

In any test it is important to make sure that the tracer used has an average life long enough to ensure that its activity does not fall off too rapidly before the end of the test.

Tracers with long half-lives cause contamination of the specimen and of the container over a long period unless carefully cleaned. They are generally unsuitable for therapeutic use.

At the present time there are some 70 tracers available. It will thus be recognised that there is a wide field of application for this tracer technique which is rapidly becoming a useful aid in many kinds of scientific research. As a monitoring aid it is finding increasing employment in industry.

NEW CAMERA WORLD'S FASTEST



This is the fastest photographic camera in the world. It was built by a British firm to meet the specified requirements of the United States Government. The shutter of the camera is operated by electronic equipment. Its speed is such that it can take six pictures in the time a rifle bullet travels one-twentieth of an inch down the barrel of a gun, after being fired.

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NEWS AND VIEWS OF THE MONTH

New plane for R.N.

A SHORT Seamew, further details of which were released recently, is to undertake a sales tour of the Middle East and certain European countries.

The Seamew, an anti-submarine and maritime reconnaissance aircraft designed for quick and cheap production, is to enter service with RAF Coastal Command in the very near future and later with the Royal Navy.

Its cheapness and ability to take off into a 12 knot wind in about 150 yards are but two of the features that have aroused interest abroad and created the demand for the sales tour, which will start in the early spring.

Sees in the dark

A BOSTON physicist has displayed a device for seeing in the dark.

The physicist, Dr. Bruce Billings, has called the device Eva.

Eva, short for evaporograph, looks like an ordinary camera on a tripod.

Dr. Billings displayed a photograph Eva made of a man taken at 200 yards on a black, moonless night.

He said Eva could "see" a house a mile away, and proved it by showing a night shot which revealed a faraway island and other objects in Boston Harbor.

Dr. Billings said that instead of focusing reflected light, like ordinary cameras, Eva gathered the heat radiation sent out in varying degrees and wave lengths by various objects, and focused these radiations on a thin film of oil.

A small camera built into Eva took color pictures of images formed on the oil.

Quiet jets

ACCORDING to a report released by the Boeing Co., jet airliners due for delivery in 1958 will be no noisier than present day propeller-driven aircraft.

The prediction was made in a paper presented to the Institute of Aeronautical Sciences by a Boeing engineer, Mr. H. Withington.

He said that considerable work remained to be done on the muffling of jet noise, but the progress was very encouraging and nozzle devices had already been built to reduce jet noise with only minor lessening of engine performance.

Radiation danger

POSSIBLY hundreds of harmful mutations have already been caused by radioactive fall-out from atomic tests, a group of scientists estimates.

They accused the Atomic Energy Commission of "misleading" claims about the effect of radioactive fall-out from these tests.

The five scientists in the group are members of the Cambridge (Massachusetts) branch of the Federation of American Scientists.

They said they believed the effects of radioactivity fall-out were big enough to be given weight in making policy decisions concerning nuclear tests.

"It is misleading for the Atomic Energy Commission to call the effects of weapons tests 'negligible' on the basis of present statistics," they declared.

The group agreed with the Commission that the amount of radiation exposure from all nuclear weapons tests to date was very small in comparison with radiation from natural sources.

The average genetic effect of medical x-rays each year was "about the same as, or perhaps twice as much" as the effect from atomic fall-out.

An estimated 100 seriously affected offspring might be an "undetectable" increase in the 100,000 or more harmful mutations appearing each year among the 4-million births in the US.

"But a certain number of individuals is involved," the group said.

"And the number may not be 100, but 10 times that large.

"As individuals we are sensitive to the value of the individual.

"From this viewpoint the number possibly affected can hardly be called negligible."

New French jets

FRANCE'S first turbo-jet airliner will be in service by 1958.

The plane, named the Caravelle, will fly at nearly 500 mph.

POPULAR SCIENCE QUIZ

Q: What is "Jetography"?

A: Jetography is a contraction of the two words "jet" and "photography". It refers to the business of photographing jet planes in flight.

Such photographs are of extreme importance in evaluating the performance of new planes, since they can show stressing of the wings during various manoeuvres, air flow near the plane, behavior when launching rockets and so on.

To obtain such photographs, the photographer has to time his shots to a split second and manipulate various cameras, while travelling in a second plane almost as fast as the one he is photographing and describing just as erratic movements to reach the required photographic vantage points.

Q: What is the current world speed record for a railway locomotive?

A: A few months ago a French electric locomotive set a speed record of 205.6 mph. French railway engineers are following up this effort by experiments with robot control of such locos, in line with similar experiments in other parts of the world.

Q: What is einsteinium and fermium?

A: Einsteinium and fermium are respectively the names of elements number 99 and 100 of the periodic table. They were so named after the late Albert Einstein and the late Enrico Fermi. Their chemical symbols are respectively E and Fm.

Q: Is it possible to operate an electric light without connection to batteries or external power lines?

A: Yes. Any radio amateur will tell you that a lamp connected to a wire loop will glow brightly if brought into the field of a transmitter "tank" coil. Fluorescent tubes and lamps will glow in certain such cases, without any external connection.

A much more useful device, however, is currently under development by the US Navy. The idea is to bombard certain phosphors with rays from a piece of radioactive strontium 90, causing them to glow brightly after the manner of a luminous watch face. One lamp, which has been produced, glows ten times more brightly than moonlight. Hopes are held that it will provide a source of light for navigational purposes or during battle, which will be independent of external power supplies.

Q: Can faulty television picture tubes be repaired?

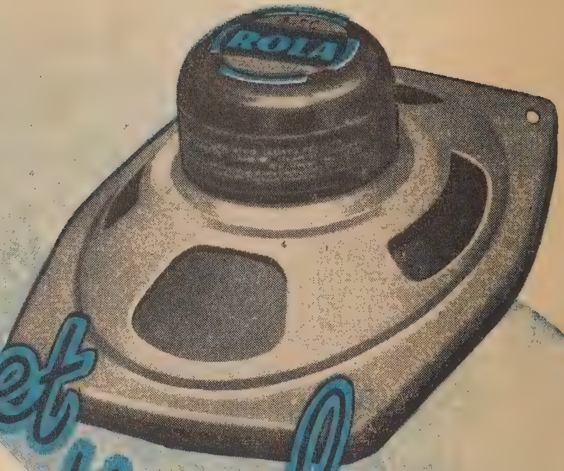
A. Repairing faulty picture tubes or offsetting the faults in them is big business overseas, mainly because the cost of new replacement tubes is so high.

When the cathode suffers from low emission, a small auto transformer inserted in the filament line increases the heater voltage by up to 25 pc and gives a further period of operation. A similar 1.1 isolating transformer offsets the effects of heater/cathode shorts.

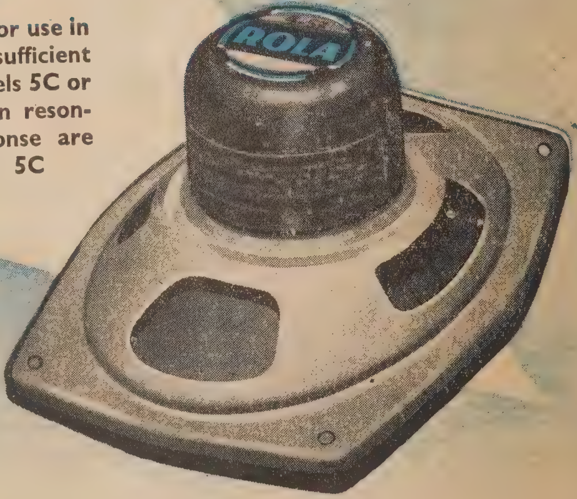
Servicemen are happy to re-sweat base pins and even employ repair gadgets in an attempt to mend open circuits, while flashing is often employed in an attempt to clear shorts.

All of these techniques could apply to ordinary receiving tubes but the time spent in fiddling with a doubtful tube is often worth more than the price of a new one. Not so with picture tubes — hence the changed attitude to salvaging them.

New Midget Ellipticals



Models 4-5C and 4-5F are for use in midget receivers where insufficient height is available for Models 5C or 5F. Their cone area, main resonance and frequency response are similar to that of Model 5C with an F87 cone.



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Prototype of the Caravelle made its first flight last May, two years after the State authorised its designers to go ahead with production.

The Caravelle is named after the timber sailing ships of the 16th century explorers.

Air France has ordered 12 Caravelles, with an option on 12 more, assuring France of a competitive position in world aviation by 1958.

The Caravelle's Rolls Royce Avon engines give it a range of about 2500 miles, at a cruising speed of about 480 mph.

Air France expects to use Caravelles on medium distances, such as from Paris to Algiers, or to Cairo by way of Nice and Rome.

Atomic planes

POWER equivalent to that contained in 1½-million gallons of aviation fuel could be replaced by a single pound of uranium 235.

The Society of British Aircraft Constructors said this recently.

The society was discussing an announcement that Rolls-Royce was working on atomic power units for aircraft.

It said a long-range conventional aircraft, carrying fuel for 5500 miles, would be able to fly the same distance with one-twentieth of a pound of uranium 235.

Atom-powered aircraft would probably use jet propulsion in some form.

But the temperature of discharged gases might reach 4000 degrees Fahrenheit.

In a conventional turbojet this was about 1500 degrees.

The development of metals which melted at very high temperatures was consequently of prime importance.

Another problem with atomic aircraft engines was the shielding of the crew and passengers from radioactivity.

This necessitated a metal screen of great thickness.

If lead were used it would have to be two feet thick, incurring a huge weight penalty.

Expanding TV

BRITISH TV licences show a phenomenal increase in number since 1951. In that period, the number of TV licences rose from one-million to 4,600,000.

In the US the corresponding rise was from 13,500,000 to more than 36-million.

The United Nations Statistical Year Book gives these figures.

The book said Britain and the US had about 90 pc of all television sets in use in the world last year.

Canada was in third place with 1,407,000 sets.

Milady wears oil

JAPANESE scientists claim to have made a cloth to rival nylon from castor oil, coal and petrol.

They claimed also to have manufactured sugar from wood.

The newspaper Asahi reported the discoveries at the Noguchi Laboratory, Tokio.

The fabric inventor, Professor Sasaki, of Kyushu University, said it was easier to dye than nylon and had more resistance to heat.

The newspaper said workmen were building a test factory to process the new grape sugar from wood

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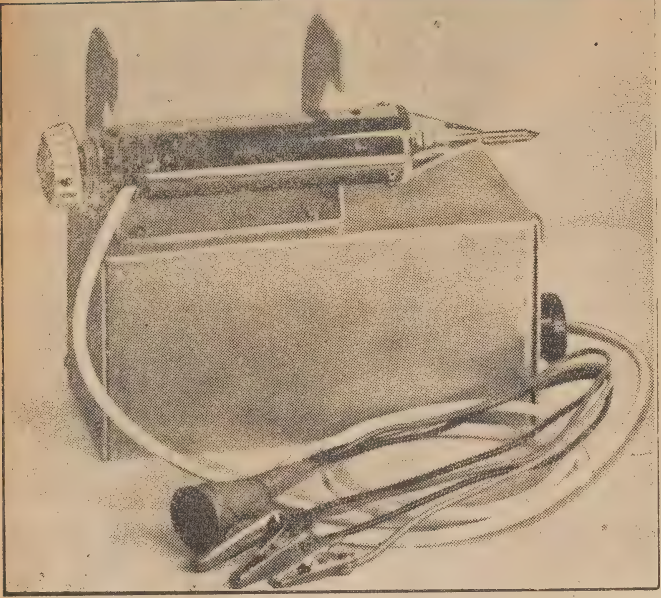


Here is the Signal Injector complete with bench power supply and rest. The adaptor lead for field use can be seen in the foreground. Output control is by means of the knob on the end of the probe.

PROBE TYPE SIGNAL INJECTOR

Time is worth a lot of money today and, if the time spent on servicing radio sets can be reduced, everybody concerned stands to benefit. In this article we propose to describe a test instrument which can be used with advantage to this end, the signal injector. It fills an important gap in service equipment and should be of considerable help to those of our readers who have to service radio equipment.

SIGNAL generators and tracers are most important pieces of equipment in any service workshop. It cannot be denied, however, that, for routine testing of radio receivers, where the fault is more often than not an open screen resistor or a faulty valve, they are rather cumbersome and time wasting to use.

ON THE SPOT TESTS

Also, by their very size, they are not very useful in field testing, whereas a signal injector can conveniently be accommodated in the toolkit, to be used on location where necessary.

Besides being convenient to use, it also combines the features of the above two instruments to a large extent, thus obviating the need for them in many cases.

The idea itself is not new, although miniaturised construction is rather novel. Basically the signal injector is built up around a conventional multivibrator circuit giving a highly distorted angular waveform (square, triangular or pulsed) at a frequency of around 600 to 800 cps.

In the older instruments the multivibrator and associated components were accommodated on a small chassis, the output being fed to the set under test via a cable and test prod. Their operation is not difficult to understand.

Touching the prod tip to different parts of the receiver produces a signal in the loudspeaker, if the following circuits are operative.

A faulty stage, however, prevents the signal from passing and can be found by following the circuit back from the output valve with the probe, the signal becoming weak or disappearing altogether when th faulty stage is reached.

by

L. Varady

Thus the signal injector works by feeding a signal into successive stages, as opposed to the signal tracer, where a signal is tapped off successive stages.

These older instruments were tie to the bench, because of their siz However, today, with miniature components freely available, it is n unduly difficult to fit the whole signal injector into the probe itself.

For bench use, a small pow supply can easily be made up fro odds and ends, while for field u the receiver under test can supp the small amount of filament ar HT power required.

A very attractive and useful instrument can be made this wa which can supplement the sign generator and tracer and replace th traditional "wet finger" metho which has become rather difficu with the introduction of singl ended valves.

Being small, it can enable th user to localise faults on the spo and possibly repair them, witho having to take the set back to th workshop.

By this we do not mean to sa that, from now on, signal generato and tracers will be obsolete. simply means that in certain case faults can be located with much le trouble.

Many readers will rightly as how an audio signal can be p through channels intended to hand only RF. Were the signal injecto to produce a sinusoidal wavefor this objection would indeed be vali The instrument would only be useful in the audio section of the receiver.

STRONG DISTORTION

However, as we pointed out earlie the multivibrator produces a high distorted waveshape. Now a distorted waveshape indicates the presence of harmonics and it is th higher harmonics of the fundament operating frequency which can ent RF circuits.

ny waveshape can be analysed separated into a number of waves of different frequency, h are harmonically related to fundamental frequency. Such ysis shows that a square wave ade up of approximately 50 pc he fundamental frequency, the inder being higher harmonics. the sawtooth waveshape the ortion is altered in favor of harmonics.

lses of short duration contain little of the fundamental fre- cy but is rich in the higher onics.

actual fact, although the repeti- frequency of such pulses may ell within the audio range, they ain harmonics ranging in fre- cy up to several megacycles per nd.

RP PULSES

e present instrument provides tput of such sharp pulses, which found to be most useful in this of work.

is explains how a signal in- r can provide a signal for any it tuned to any frequency. It in a large number of different encies—the harmonics—and the d circuits accept those which spond to their resonant fre- cy.

me portion of the signal will ately reach the loudspeaker, no er whether we feed it into the of the output valve or that of converter!

ltivibrator circuits have been for many years in different ications, where angular wave- s were required, such as for ision time bases, binary counters pulse transmission equipment.

multivibrator consists of two, lly identical, valves, or two e systems in a common envelope. triodes are most commonly , as in the present design. The valves operate under identical itions. the grid of one valve fed from the plate of the other gh a small capacitor. The out- from the system can be taken one of the plates, or, if a de resistor is employed, across resistor.

r the purpose of illustration, let ssume, that both valves on our am are in a conductive state, they reach operating temper- e.

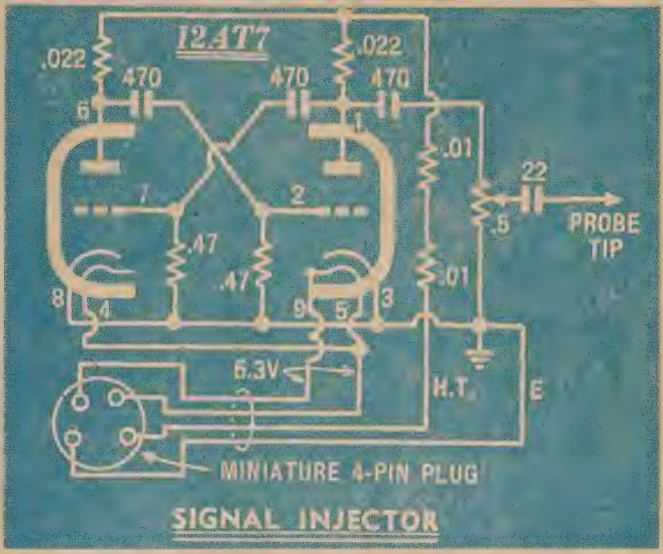
LL VARIATION

now, by some external voltage tion the grid of the left hand e receives a small positive- signal, this valve starts to heavier plate current. Due to voltage drop across the plate tor a negative-going pulse ars on pin 6. The initial small l on pin 7 will of course be ified by the valve and a con- ably larger pulse will thus pin 2 via the coupling itor.

is negative-going pulse will cut he plate current of the right valve, causing a large positive- pulse to appear on pin 1, and, gh the coupling capacitor, on 7. This positive going pulse ents the initial small positive causing the valve to conduct heavily, until saturation point ched.

the same time, these pulses e up the coupling capacitors.

CIRCUIT DETAILS OF THE PROBE



Here is the circuit of the multivirator, as used in our signal injector. The coupling capacitors and grid resistors could be varied to give a different tone. The capacitors between plate and pot and between pot. and probe tip effectively prevent DC from reaching the pot. from either direction.

However, there is a resistor between each of the grids and cathodes, so the charge tends to leak away. As it leaks away, the high negative voltage on pin 2 diminishes. Ultimately the right hand triode starts to conduct and a negative-going pulse appears on pin 1, causing the left hand valve to cut off.

The two valves alternately conduct and cut off, as long as the supply voltages are connected.

The important point to remember is that the change from cut-off to conduction occurs with a rush, almost instantaneously, thus giving a very sharp pulse, containing a lot of harmonics. The actual duration of the conducting or cut-off state is determined by the time constant of the coupling capacitor-grid resistor combination.

It follows that the pulse duration, and the pulse frequency can be varied within wide range by altering these two values.

The initial pulse starting off the oscillations may come from many sources. Some slight unbalance of components, or difference in heating time of the two valve systems is quite sufficient.

This multivibrator circuit is the heart of the signal injector. The only other items required to adapt the circuit to our purpose are the .02 meg dropping resistor, to prevent excessive voltages from being applied to the valve, and the output control potentiometer as a means of varying the output voltage.

PARTS LIST

FOR THE SIGNAL INJECTOR

1 probe housing type 4X7/8 (Jabel)
1 12AT7 valve.
1 Noval valve socket (solid moulded.
1 min. Potentiometer .5 meg. type BJAI 50410.

RESISTORS

2 .47 meg. 2 .002 meg. 2 .01 meg. all $\frac{1}{2}$ w.

CAPACITORS

3 470 pf, 1 22 pf disc, ceramics.

FOR THE POWER SUPPLY

1 power transformer 150/30 ma.
1 6H6 valve.
1 8 mfd 600 V electro, chassis mounting.
1 Octal socket.
1 box, min. size $2\frac{3}{4}$ x $2\frac{3}{4}$ x $5\frac{3}{4}$in. ins.

SUNDRIES

5/010 hookup wire, 1 min 4-pin plug, 2 sockets to suit, brass strip, aluminium for bracket, small piece thin coil former spaghetti, grommets. Mains E. flex and plug.

HOW TO MAKE IT

This brings us to the constructional details of the instrument. With a little care, the whole circuit can be built up inside the probe housing.

Our instrument was built into a commercially made probe, type 4X7/8, approximately four inches long and with an inside diameter of 7/8in, with transparent plastic ends. One of the ends is cone shaped and contains the probe tip.

However, there is absolutely no reason why the probe housing could not be fashioned from a suitable piece of thin-walled brass tubing. The end pieces could well be turned or shaped from a block of plastic of suitable size.

Tubing of slightly larger diameter

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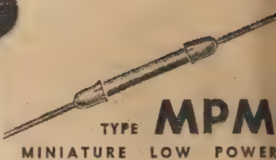
HIGH FREQUENCY RESISTORS

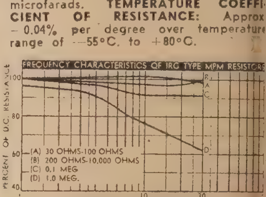


TYPE MPM

MINIATURE LOW POWER

IRC Type MPM Resistors are miniature units suitable for high frequency receiver and similar applications. Resistor body is 9/16" by 0.100" (over cups), and the active resistance section is 3/8" long.

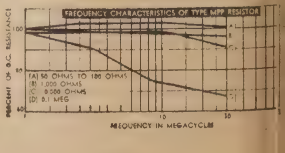
RESISTANCE VALUES: 30 ohms to megohms. **TOLERANCE:** Standard ±20%. Special ±10%. 5% not available. **POWER RATING:** 1/4 watt, at 40°C. ambient temperature. **MAXIMUM VOLTAGE RATING:** 200 volts peak. **CAPACITY BETWEEN TERMINALS:** 0.015 Micro-microfarads. **TEMPERATURE COEFFICIENT OF RESISTANCE:** Approx – 0.04% per degree over temperature range of —55°C. to +80°C.



TYPE MP

MEDIUM & HIGH POWER

Contact your usual supplier for full details.



The range MPF to MPR Medium and High Power High Frequency Resistors, rated between 2 and 90 watts, are designed for frequencies above those of conventional resistors. They are suitable for such applications as broad band RF amplifiers, RF probes, rhombic antenna terminating resistors, dummy loads for transmitters and dielectric heating equipment, television side-band filters, surge generator and other circuits involving steep wave fronts, high frequency measuring circuits and radar pulse equipment.

RATINGS indicated are maximum based on free air operation at 20°C. ambient. **DERATING** curve is available on application. **TEMPERATURE COEFFICIENT:** —.005%/°C. for low values, —.07%/°C. for high values. **HUMIDITY:** Several protective coatings of special varnish, each baked at high temperature, provide protection against effects of abnormal humidity.

TYPE	Power Rating	Peak Voltage Rating	Minimum Available Resistance at 20% Tolerance	Maximum Available Resistance at 20% Tolerance	Dimensions	
					Ceramic Length	Resistor Body Diameter
MPF	2 watts	500	20 ohms	1.5 megohms	1-3/4"	5/16"
MPG	4 watts	500	20 ohms	1.5 megohms	2"	9/16"
MPJ	5 watts	1000	35 ohms	3.0 megohms	3"	9/16"
MPP	10 watts	1750	25 ohms	2.5 megohms	4-1/2"	3/4"
MPA	20 watts	2750	35 ohms	4.0 megohms	6-1/2"	1-1/8"
MPO	30 watts	4750	50 ohms	5.0 megohms	10-1/2"	1-1/8"
MPR	90 watts	8500	60 ohms	6.0 megohms	18-1/2"	2"

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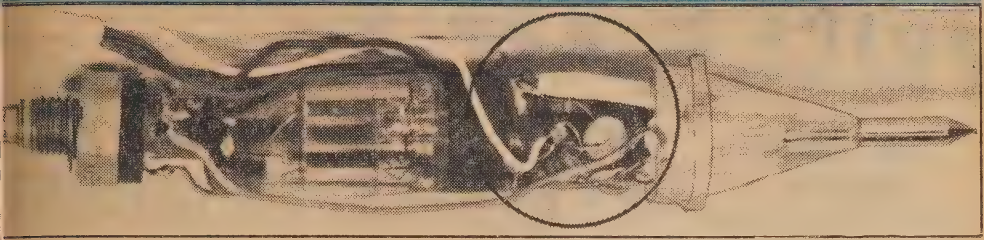
CONSTRUCTIONAL DETAILS OF INJECTOR PROBE



ne complete multivibrato circuit is built up inside the probe. This photograph shows the mounting of the major components. The placing of the sma'ler components within the circle is indicated in the enlarged diagrams below.

ld also accommodate a miniature entiometer other than that used in original. There are several types ilable as standard lines, although are slightly larger. However, are also a lot cheaper than the shown, and the reduced cost ild perhaps offset the inconveni- e caused by a bulkier instrument.

he whole circuit is built up on probe tip which supports the e socket. A thin brass strip bolt- o the inside of the tip provides a venient earth connection and port for the potentiometer.

one of the available socket types small enough to fit inside the be, so it was necessary to modify for the purpose. We used a solid lded type 9-pin miniature socket h the metal mounting lugs re- ved and the periphery of the ket ground off to within 1/16in of contacts. This made the socket ll enough to allow the connect- wires to pass alongside it.

o mount the socket we fixed a er lug under the clamping nut he probe tip and screwed a small lating pillar about ½in long r the remaining portion of the ad. Over this pillar we pushed nall piece of coil former tubing in diameter and about 15/16in g.

CKET MOUNTING

he socket spigot was then pushed this tubing to hold the socket position. It fits quite tightly and not likely to work loose, once connections have been made.

wo holes drilled through the ng and the pillar at right angles ach other, so as to miss both the aded portion of the probe tip the socket spigot, hold two short es of 16 gauge tinned wire. These ld not touch each other, as they serve as terminal posts for the lead and Earth when the wiring ompleted.

he output potentiometer mounts he rear end of the bracket with shaft protruding through the tic cap. The potentiometer, e by Morganite for subminiature pment, fits quite easily inside tubing. As against conventional ntiometers, its connecting lugs on its rear end rather than on side.

ost of the room inside the probe aken up by the potentiometer, valve and the socket, so that the ing has to be done very carefully, verything is to fit in. Needless ay, only the smallest available components should be used. For the same reason 5/010 hookup wire is desirable. This is only about half as thick as ordinary hookup wire and makes the task of assembling the probe much easier.

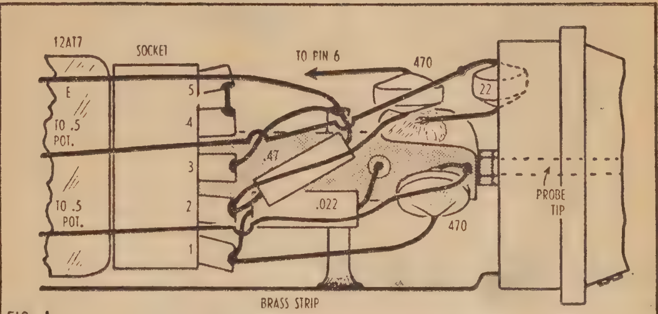


FIG. A

Looking at the wiring from one side clearly shows the terminal post soldered to the brass strip for earthing. The .022 meg. resistor is shown attached to the second terminal post. Lead junctions of the 470 pf and the 22 pf coupling capacitors can be seen floating.

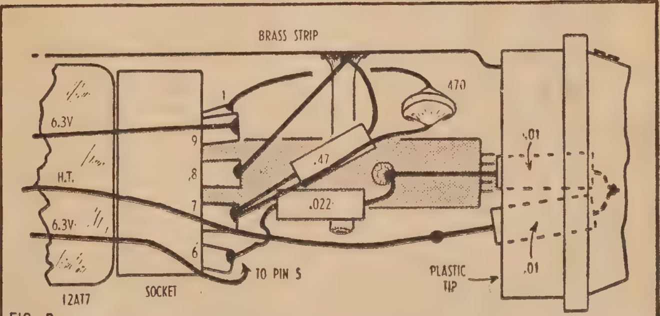


FIG. B

Viewing the wiring from the opposite side reveals the heater and HT leads, and the HT dropping resistors. The junction between the HT lead and the dropping resistor should be covered by plastic sleeving.

BTS type resistors and disc-type ceramic capacitors can be fitted quite easily into the available space. Even so, it is best to cut back the socket lugs as far as possible, though care should be taken not to cut off the retaining spurs on the contacts. This helps to gain a little more room for the components.

Before attempting to fit the components into the probe, the circuit should be wired up temporarily breadboard style and the coupling capacitors and grid resistors adjusted to give a tone to suit individual taste.

The wiring is probably best started by installing the plate resistors which connect to their respective socket terminals on the one side and to one of the terminal posts on the other. Similarly the grid resistors are connected to their respective pins and the other terminal

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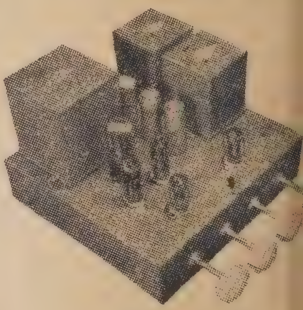

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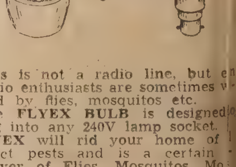

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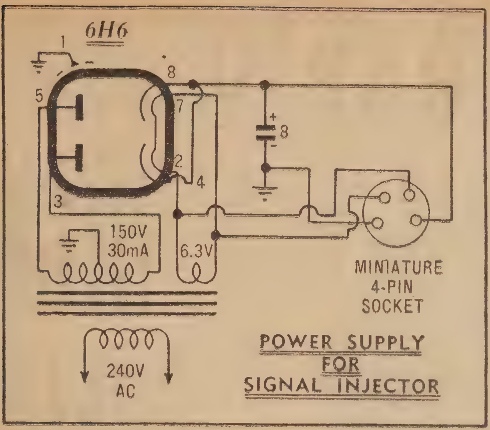


circuit reveals simplicity of power supply. one filter icitor is re- ed, because strong hum d not affect the e operation. rectifiers are p and last long, other types uld be used.

☆

This post should be earthed to brass strip, and the cathodes connected to it.

ic coupling capacitors are con- ed between the grid and plate and their leads folded flat ıst their sides so as to take up ttle room as possible. This also es to the output coupling citor. The junction between the ntiometer lead and the coupling citor on the plate side is pushed into the cavity of the probe

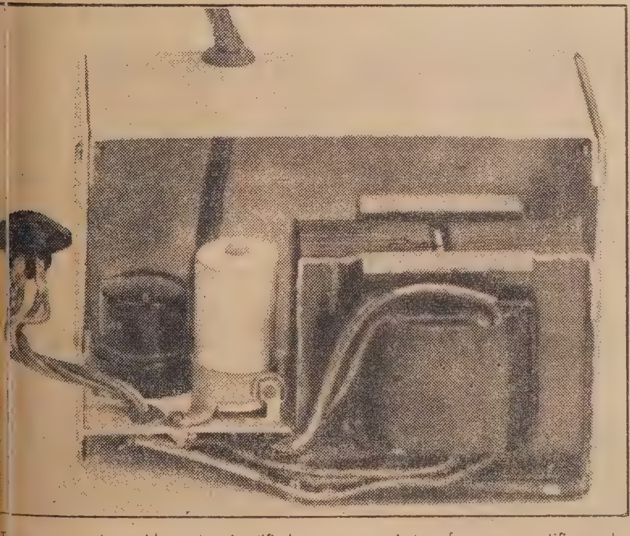
nother cavity in the probe tip ins the 22 pf capacitor between metal tip and the potentiometer the third one provides room the two .01 meg dropping re- rs. The HT lead connects to of these resistors, and, to avoid s, the junction and the body e of the resistors is encased in a piece of plastic tubing.

ter connecting the supply wires heir respective terminals, the is ready to be slipped into its housing. Before it can be installed, however, it will be necessary to cut a notch approximately ¼in wide and ½in deep into the rear end of the tubing to allow the leads to be passed through to the outside, alongside the potentiometer.

The metal edge would sooner or later cut through the insulation of the wires and it is desirable to slip a small grommet or double sheathing of spaghetti over them after the unit is installed.

The ceramic capacitors used in this unit are thermally sensitive and some means of ventilation should be provided. A number of holes drilled into the brass tubing around the components should be sufficient.

When fitting the unit into the tubing, it is wise to make sure that none of the wires passing the valve are crossed. The hookup wire used is not very thick, 5/010 in size, and the heat of the valve would soon soften the insulation and allow the wires to short.



T power supply could not be simplified any more. A transformer, a rectifier and o filter capacitor, all mounted on a small piece of aluminium. The transformer is n old type, later versions may require the addition of extra mounting brackets.

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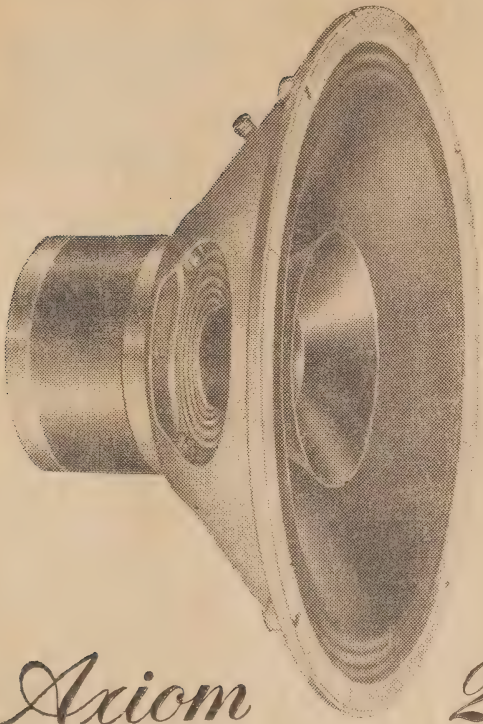

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'o complete the instrument the stic cap is placed over the end l the nut screwed over the potenmeter shaft. The P-K screws hold- the end caps may have to be rtened somewhat to prevent them n interfering with the wiring de.

'he leads — preferably after en- ing them in a length of plastic ing — are terminated in a mini- re 4-pin plug. This will enable unit to be conveniently connected its power supply, or to a small ptor with a socket and four clips, is necessary to use the set's own er supply.

espite the dropping resistor in- led in the circuit, the test prod operate reliably from HT volt- s as low as 100 volts. Most sets a minimum of 225 volts HT, and efore do not present any pro- n. For bench use, the smallest ilable power transformer, 150 V Ia, will provide almost 200 volts as the drain at this voltage is than 3 Ma.

'NOTE: SIMPLICITY

implicity is the keynote of the er supply, as it only consists of power transformer, a rectifier e and one 8 mfd electrolytic give some measure of filtering. of the 6V rectifier types could ised in the power packs if they on hand, although there is a iper course open.

our power supply we used a double diode as the rectifier, type being obtainable at a tion of the price of other types disposals sources. Although application does not carry the ufacturers blessing, 6H6's have ved very reliable under these litions.

e rectifier socket and the up- t type electrolytic are mounted a small bracket which attaches e side of the power transformer. ls from the power supply are ninated on a miniature 4-pin et which attaches to the side of container. The container is a ll aluminium box 2¾ x 2¾ x 5¾ins, h can be bent up from sheet ninium. This represents the imum size but any suitable box d be adapted for the purpose.

BE REST

aluminium bracket on top of box serves to hold the probe n not in use, and as a carrying lle when necessary.

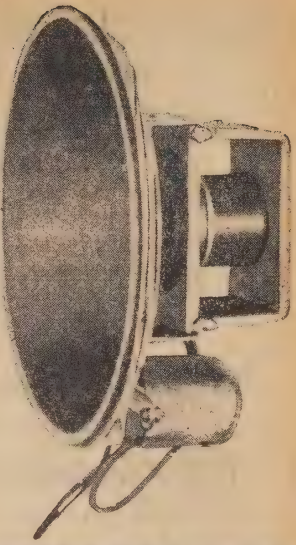
r on-the-spot checks a small tor lead is made up of a 4-pin ature socket with four leads hed to it, preferably of different s to facilitate recognition. Small es of spaghetti are slipped over pins and the soldered joints and whole socket is wrapped in thin rical or cellophane tape. Alli- clips on the leads connect the tor to the set under test.

is brings us to the technique of the signal injector for fault- ng in receiving or audio equip- . The first check of course is to lish that all valve filaments are t.

ere would be little point in g to use the injector, if the ent of the output valve is usly burnt out.

e second test in the testing pro- dre is to establish that HT is nt in the set. In normal cir- ntances this would be done with

(Continued on Page 79)



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7 x 5" PM	20944/75PU	3—4	5
7"	21253/7PT	3—4	5
9 x 6" PM	21502/96PU	3—4	5
9 x 6" PM	20946/96PT	3—4	6
12" PM	21580/12PU	3—4	6
12" PM	21570/12PS	6—8	10
12" PM	21567/12PQ	12—16	20
6" PM	20766/6PU/25	20—25	2
12" PM	20928/12PQ	12—16	15

		OHMS	WATTS
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12" EM	21656/12E30	6—8	10

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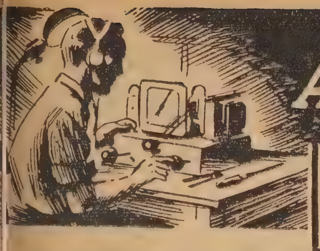


A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

ULTIMETER ADAPTED FOR NON - STANDARD MOVEMENT

A reader from Merrylands, NSW, has described the problems he en-ountered when adapting the "R. T. & H" AC-DC Multimeter to his wn requirements. His comments will be of value to other readers, who may want to do the same sort of thing.

ERHAPS we should let this reader tell his own story. He does it e well:

Iy old multimeter was long over- for a "refit" but I simply ldn't afford to do what I would e liked, namely, to scrap it and d a completely new one.

he meter movement was itself air order, although it did tend tick on odd occasions and was in a pretty grubby state. It ne of the old fan-shaped meters, bably one of the first to be le in this country in quantity.

he rest of the old multimeter in bad shape, however. The had got wet on a previous occa-, with the result that the ply-d had split, the leatherette had d in places and the old cotton-ered hook-up wire had grown a ering of fungus.

ARATE SWITCHES

he original circuit had provided t of tip jacks and a switch for separate function (volts, milli-s and ohms) so that changing ges involved shifting test leads, ng a switch and running the r switches back to positions re they didn't affect the read-

hat is more, the switches were old brass stud-type, which were r reliable at the best of times. ou can imagine, therefore, that as attracted to the circuit in May, 1952, issue, which only two tip jacks for the leads a single knob to select all ges. It was just a question as whether I could adapt this cir- to my needs, without spending much money immediately on the ect.

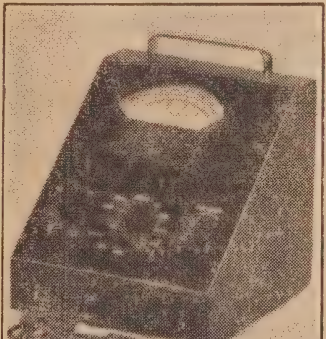
ell, I "took the bull by the ns" at the start and had a panel aved from bakelite by a firm ity engravers. I reckoned that multimeter could only be as y as its front panel and that as worth a special effort.

hile waiting for this panel to ngraved, I opened up the meter and discovered that the stick- was due to the pointer touch- the underside of the glass with meter in certain positions. A careful work with tweezers ected this fault and also re-ed another couple of slight kinks ered from previous "bashes".

The case of the meter was polished up also, using a spot of ordinary machine oil and a clean, soft rag. Reassembled, it looked quite its old self.

When the panel came to light, I dug a hole in it to receive the meter but had to be very careful and work from the front of the panel only. I found that laminated bakelite gives a very nice engraving but it splits very easily when worked with ordinary hand tools.

Fortunately, the hole required for the old meter was comparatively small and there will be no problem in fitting a more modern movement at a later date—that's if I can ever afford one with the price of everything as it is!



A snap of the finished instrument housed in a bench-style case made up by the contributor. It was knocked together from plywood scrap then covered with thin, black Vynex cloth.

Then my worries started. The meter had scales the same length for both AC and DC, so that it was obviously an 0.9 mA. type, intended to be shunted back to 1.0 milliamp on the DC ranges. I duly searched for and found the shunt wired to the old AC/DC switch.

I despaired for a while of being able to get this shunt resistor in and out of circuit on a 3 x 3 switch. However, I finally wangled things, so that the switch now works as originally intended—DC, AC, and Output.

The range switch also posed a bit of a problem to a poor man but I finally managed to scrounge enough banks and other bits and pieces to make up a 3-bank 12-position switch.

The parts were pretty grubby for a start but I cleaned them up as I went, getting rid of surplus solder, straightening bent lugs, finally washing them in petrol and going over the surface with a small brush.

I discovered, by the way, that these banks vary somewhat in their assembly, so that anyone doing likewise will have to check each position on each bank as they wire up, and not simply assume that contacts in like positions can be wired straight across.

AC/DC SWITCH

I followed the procedure of wiring up the AC/DC switch first, then wiring and testing the range switch as I went, one position at a time.

I wired the 1-milliamp position first and, checking against a new meter borrowed from a friend, I found my meter to be reading high on the 1-milliamp DC range.

Rather than fiddle with the meter, I paralleled other odd resistors across the original shunt on the AC/DC switch, until I found one that brought the reading back to exact full scale, when compared with the new meter.

Doing it this way might have meant that the meter would still read high on the AC ranges and, if this proved to be the case, I was prepared to wire the extra shunt permanently across the meter terminals.

FAIRLY ACCURATE

In the end, the AC ranges proved to be pretty close to the mark, showing that the tendency for the meter to read high balanced out rather neatly some possible deterioration in the meter rectifier.

Anyhow, with the basic 1-milliamp range suitably adjusted, I wired in the milliamp shunts from my original meter and checked them as I went. They were all close enough.

The 250-milliamp shunt by the way, was nothing more nor less than a length of thick resistance wire, which was wired directly into circuit in the original meter.

I slipped a piece of spaghetti tubing over it, folded it and then pushed it into a sleeve of larger spag.

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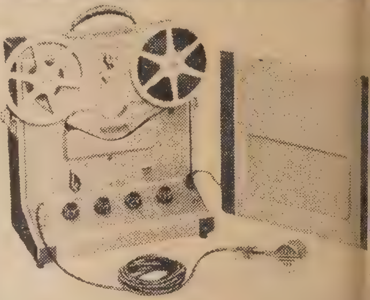

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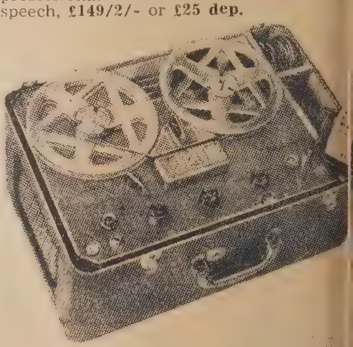

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hat it could be soldered to the ropriate points on a tagstrip, as isaged in your layout.

he voltage ranges came next and se I also checked against my nd's new meter, using for refer- e various voltages from a radio ssis.

y original meter had used a 1.0 ; resistor for the 1000-volt range I decided to substitute the four megs. as in your circuit.

o save buying new close toler- e resistors, I sorted out all the)ectable looking quarter megs. by stringing them in series with original 0.25 meg. multiplier for 250 volt range, managed to get)mbination which gave an accur- reading by comparison with the r meter.

) GUARANTEE

this meter hadn't been avail- l guess that I'd just have used original 1.0 meg. for the time g.

f course I realise that calibrating meter by another isn't neces- ly a guarantee of accuracy but east the ranges cross-check and meter does read the same as a / instrument that hasn't long the factory.

inally the "Ohms" ranges. Here ıust confess I was caught out er badly.

simply ordered the panel to be raved as per your drawing, only ealise later tht my meter face already calibrated in thousands)hms.

herefore, instead of having the ch positions marked "Ohms x &c., I should have had them ked "Ohms divide by 10" &c.

l simply have to remember the repancy in the scales and comfort elf with the thought that the ıs scales will be all right, if and n I buy a new meter at some re date.

ne other thing My meter face 4500 ohms at the centre of the e, indicating that it is intended)perate from a 4.5 volt battery a larger series resistor. Accord- y, I used a 10,000-ohm pot. for ohms adjustment, with a 3000- series resistor.

change had to be made also in Ohms range shunts. I didn't w what the exact values would out guessed that the values would ıbout three times the two resist- specified in your circuit; that x 166.6 and 3 x 14.8 ohms re- tively.

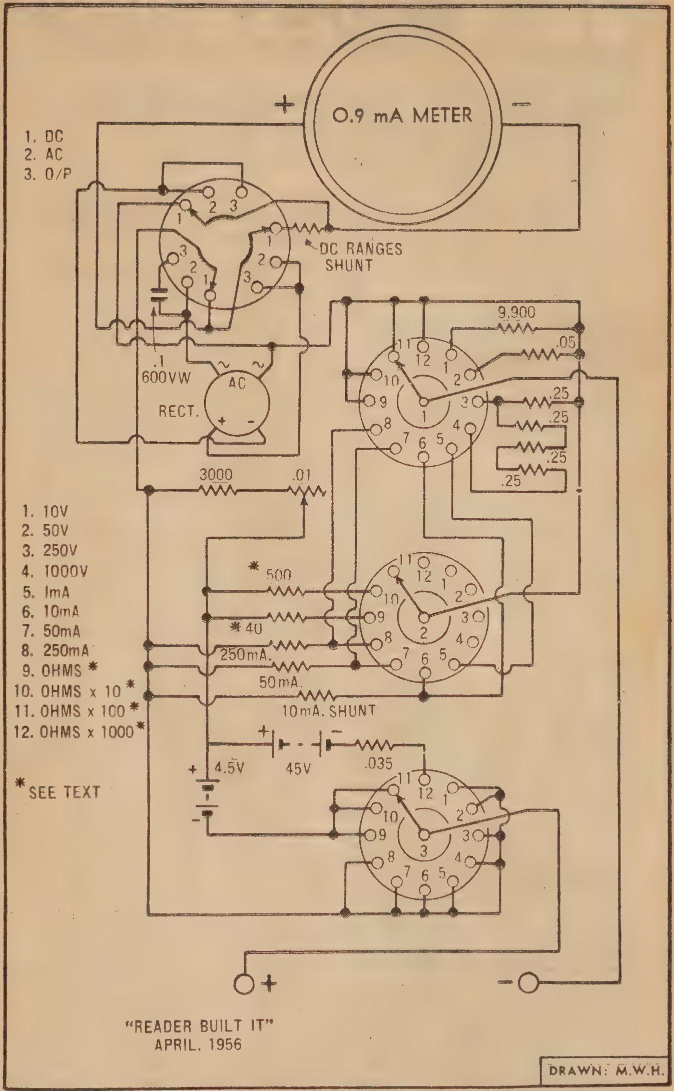
AL AND ERROR

ıe resistor box yielded several stors around 500 ohms, one of h gave the right average read- on the appropriate range, with stors of known value. On the r range I selected a resistor of t 50 ohms, that proved fairly to the mark, then shunted it higher value resistors until I the right order of readings once n.

ıe high range proved a stumbling k, however, because it demands times the initial terminal volt- — or 4.5 volts — to operate it. red in provision for a 45-volt ry and a 35,000 ohm series re- r but I won't guarantee that ange will ever be used.

rtunately, the sensitivity of an neter using a 4.5 volt battery etter than the modern practice sing a single cell for the basic ; range.

MODIFIED MULTIMETER CIRCUIT



Here is the complete circuit, amended as per the reader's suggestions. Main differences are in the AC/DC switch wiring and the ohms circuit.

Well, that's the story of my meter; a rather long story I'm afraid but I enjoyed writing it so what's the odds if it does go into your W.P.B. (No danger of that. Ed.).

Needless to say, I housed the finished article in a plywood case made up to your specifications and covered with leatherette. The sloping position of the meter is excellent because it obviates once and for all the business of propping the meter at odd angles where you can see the face.

Only one improvement can I claim —a plastic cover which my wife made up to go over it when the meter is not in use.

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Here's your answer, Tom!

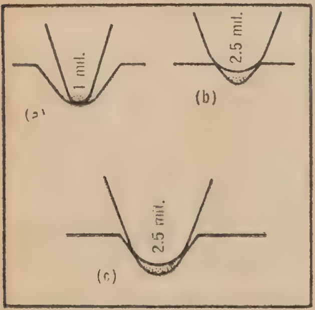
Apparently Tom has become the owner of a brand-new three-speed turntable with a turnover pickup. Otherwise he would not be asking the question that appears as No. 1 in this month's article. And, besides a few assorted items, there is also a question on the inevitable Ohm's Law.

PEOPLE invariably ask this question when they get one of those "new-fangled gadgets", so that it is really surprising that Tom has not brought up this question earlier.

Would standard records be damaged if inadvertently played with a microgroove needle and vice versa?

Well, to start with, Tom, we don't use needles in gramophones any more—except perhaps in very old models—but styli. They are made of sapphire, or even diamond, not steel.

Contrary to popular belief, these styli are not pointed, but have a rounded tip, and it is at this point, that standard and microgroove stylii differ.



Illustrating the effect of playing a standard groove (a) with a microgroove stylus. Sketch (b) illustrates a large stylus in a small groove, while (c) shows the correct relationship.

The rounding at the tip of the standard stylus has a radius of .0025in, whereas this figure for microgroove styli is only .001in. These dimensions have been agreed upon by the manufacturers of both records and styli, so that, on both types of record, the stylus may ride just slightly above the bottom of the V-shaped groove.

If we place a microgroove stylus into a standard groove, the rounded tip will not ride on the sides of the groove, but drop straight to the bottom. If you don't make a practice of using this combination, the record is not likely to be damaged, although ultimately, the bottom of the groove could be scored by repeated "playings".

It is quite another matter, what the record might do to the stylus. Dust and other foreign matter accumulate in the bottom of the groove and its abrasive action could destroy the finely-polished point of the stylus. The abrasive action would be hastened by the various kinds of fillers used in the manufacture of standard 78 rpm records.

It is only commonsense that a stylus, so damaged, should not be used for playing any kind of records any more, certainly not microgroove records.

The position is much more serious if microgroove records are played with a standard stylus. This is particularly true of pickups which use interchangeable heads, where the 78 rpm head is heavier than the microgroove head.

Microgrooves, as their name indicates, are very narrow and should only be played with a stylus having a .001in tip radius. The standard stylus, being much bigger, will ride very close to the top of the groove, possibly damaging the groove walls. As it is not seated in the groove properly, it will also jump the groove at the slightest provocation, putting a nasty scratch right across the record.

To play microgroove records with a standard stylus has been likened in the past to playing them with a plough. So—watch what you're doing, Tom!

The next question holds considerable interest to those that have to deal a lot with high current equipment.

Is there a difference between the specific resistance of hard-drawn and annealed copper?

There most certainly is, Tom, although for radio work the difference is only of academic interest. This is mainly so, because the fractions of ohms involved would make very little difference, considering the low current densities in radio work. In any case, hard-drawn copper wire is seldom used in radio sets, except perhaps for aerials.

It does, however, assume considerable importance in the distribution of electric power, where current densities of a thousand amperes and more are not unusual.

The increased resistance of hard-drawn copper wire is largely due to the crystal structure of the metal which changes according to the treatment the wire receives during manufacture.

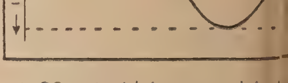
In the standard specifications, rigid limits are laid down for the resistance of annealed copper wire. Thus the resistance of one of the usual wire sizes used in electrical wo 1/.036, is given as 24.01 ohms 1000 yards. Against this, there no specifications laid down for same size hard-drawn wire.

Instead, it is worked out fror formula, taking into account the sistance of the annealed wire of same size, and the tensile strer of the wire in tons per square in. The formula gives the percent increase of resistance. This is w it looks like:

$$P = \frac{T}{10}$$

Where P is the percentage in crease of resistance, and T th tensile strength in tons per s in.

Assuming that the above wire a tensile strength of 30 tons/sq. the formula gives an increase resistance of 3 pc for hard-dr wire.



A DC potential is compared in sketch to an AC potential having same RMS value.

Not much, you might say, but, with large amounts of cur an increase in resistance of 3 pc results in an appreciable crease in wasted power along supply line, particularly where runs of cable are involved.

And now to a question whic better not decided by a prac test.

Has AC more kick than D

It all depends, Tom, on what mean by the "kick". Theoreti the energy content of both DC AC is the same if the RMS voltage and the DC voltage equal.

.us it does not matter whether
usc 240 V AC or 240 V DC
'unning your radiator. The re-
ng heat will be the same. Nor
it matter, whether you use
or the other for running motors.
ugh for traction purposes DC
rs are usually preferred. This
d indicate that DC does have
kick than AC. The real rea-
however, is that for equal physi-
ize, DC motors can be made
efficient than single-phase AC
rs.

t you could turn this argument
other way, too, because three-
AC motors are more efficient
than their DC driven counter-

ere is one "application", how-
where AC does definitely have
"kick" than DC. This is when
ltage is applied to the human
. The difference in effect is
ly due to the fundamental dif-
ce between AC and DC.

you know, Tom, direct cur-
flows in one direction only,
remains at a constant voltage.
on the other hand, rises to a
in voltage, reaches a peak,
ges in direction and reaches
er peak opposite in direction
e first one.

w the RMS voltage of AC pro-
the same effect—in terms of
and heat—as the same DC
ge, but peaks referred to in
previous paragraph reach con-
ably higher levels for short
ds. The peak voltage reached
C is roughly equivalent to 1.4
the RMS voltage.

is would work out at about
volts for 240 AC. Now the
r the applied voltage, the more
nt the reaction of the human
to its application. The con-
ve action of electricity is also
ened by the fact that, with AC,
pplied voltage comes in series
lses in rapid succession, rather
a steady value.

you can see, Tom, that in this
AC has a lot more kick, than
. Take our advice: don't try it.

**Vhat is a direct-coupled am-
ier?**

conventional amplifiers, as have
published in this magazine
the years, the amplifier stages
usually resistance-capacitance
ed; that is, to say the signal
ge is developed across the plate
or of the valve and fed to the
ving grid through a capacitor
itable size.

s latter is necessary to block
C plate voltage from reaching
rid of the next valve, and to
nt it from upsetting the oper-
bias.

s is the only purpose of this
ing capacitor. The main dis-
tage is that, at very low fre-
ies, its impedance may become
in comparison to the imped-
of the following grid resistor
he two start acting as a regu-
oltage divider, preventing part
low frequency signal voltage
reaching the grid.

a signal of zero frequency—
you—the impedance of the
ng capacitor becomes infinitely
so that DC amplification is
ossible with R/C coupled am-
s. Also, for sustained response
ry low frequencies—below 10
c/s—the size of the coupling capacitor would have to be prohibitively high, possibly of the order of several microfarads.

So some other arrangements have to be found, if the amplifier must handle DC and very low audio frequencies. We have said earlier, that the coupling capacitor has to prevent the DC plate voltage from upsetting the bias on the following grid.

However, if we arrange the following stage in such a fashion as to cancel out the effect of the DC plate voltage, the coupling capacitor need not be employed. This is where direct coupling comes in.

CATHODE VOLTAGE

The cathode voltage of the second valve is kept at a voltage somewhat higher than the plate of the preceding valve. The plate of the first valve can now be connected directly to the grid of the second valve, because the difference in voltages will provide the necessary operating bias and the grid will still be negative in respect to the cathode.

Thus the main difficulty introduced by the use of a coupling capacitor is eliminated and, theoretically, such an amplifier will be capable of amplifying any frequency from DC to many Kc.

An immediate problem is the high B-plus supply voltage required. This must now be equal to a little less than the plate voltage of the first valve plus the plate voltage of the second valve. This need becomes clear if you consider that the cathode of the second valve is already at a higher voltage than the plate of the preceding valve and, for correct operation, the plate of the second valve must be kept at a still higher voltage.

It will also be clear that operation of more than three stages in a direct coupled circuit becomes impractical, because the total HT voltage must always be the sum of the plate voltages of the individual valves.

Another problem is that of stability, arising from the fact that variations in voltage and current, as the first valve ages, are amplified by the second valve. In a bad case, the operation of the second valve can be completely upset.

And to round up the article here is a question which has a lot to do with Ohm's Law.

For the final resistance value, does it matter whether resistors are connected in series or parallel?

It does, Tom, and then again it does not. It would be possible to connect two resistors in series, and another two in parallel and arrive at a common value for both combinations.

The important thing to remember is that if you take two resistors and connect them first in parallel and then in series they will give you altogether different resistance values for the two combinations.

Let us see, from an example, what is meant by this. If we have two resistors of, say 20 ohms, connect them in series and apply say 2 volts to the two outside ends, it is quite obvious that the current must flow first through one and then through the other. If we measure

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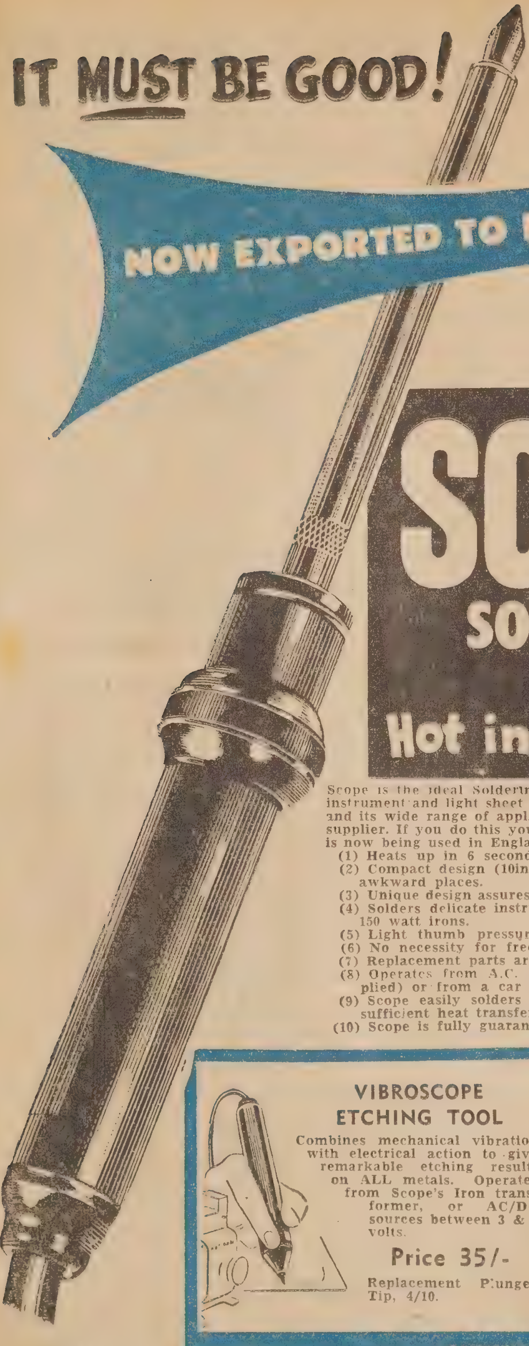

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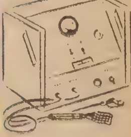

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current through them, we will
, that it will be the same as
ugh one 40 ohm resistor —0.5
.

e can therefore safely say, that
total resistance of several re-
rs in series is equal to the sum
he individual resistances. Not so
with resistances in parallel,
ever.

t us connect our two 20 ohm
tances in parallel and apply 2
to them. Now a potential dif-
nce of 2 volts exists across each
tor. From Ohms Law we can
out the current through each
tor would be 0.1 amp. The re-
rs being connected in parallel,
current through both resistors
flow through the leads to and
the battery.

these leads, therefore we have
tal current of 0.2 amp. Again
Ohms Law we can work out
the actual resistance in circuit
an applied voltage of 2 volts
a current of 0.2 amp. It works
at 10 ohms.

the same way, any other re-
nce value can be made up by
ecting resistors in series or in
llel. Furthermore, Tom, you
not even go to the trouble of
ing out the individual currents
tain the final resistance value.
e is a simple formula, which
s you to work out the actual
tance of two resistors in parallel.
total equals R1 x R2/R1 plus R2

How could I tune a receiver to
fferent frequencies without the
e of a variable capacitor?

e problem is not quite as hard
may appear on the surface and
commercial sets were produced
g the war, when tuning gangs
scarce, using such other
ods of tuning.

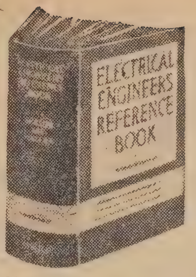
ning a receiver actually means
all tuned circuits in the re-
r are adjusted, usually simul-
usly, to resonate at the same
ency on any spot on the dial.
is is usually done by reducing
creasing the capacitance in each
ese tuned circuits.

wever, a tuned circuit always
ists of capacitance and induct-
, and its resonant frequency
nds on the amount of each in-
d in the circuit. The resonant
ency varies with any change
pacitance, but it also changes
any change in inductance.

is therefore possible to tune a
ver by changing the inductance.
ng other things, the inductance
coil depends on the number of
and the size and position of
ron core, if one is used.

e inductance could be varied.
fashion, by connecting taps to
coil at regular intervals and
ng the number of turns in cir-
connecting different taps via
tch. However, only stepped ad-
ent can be achieved this way,
oarse to be of any practical

more practical approach is to
the position of an iron core in
coil. This gives a continuous
tion of inductance and is more
le for tuning. The idea works
well, while only one tuned
it is involved, but is likely to
ne troublesome, when adjust-
s for several circuits have to be
d. This was the main reason,
inductance tuning was dropped
y from commercial production.
each case, the capacitance in
it would be fixed.



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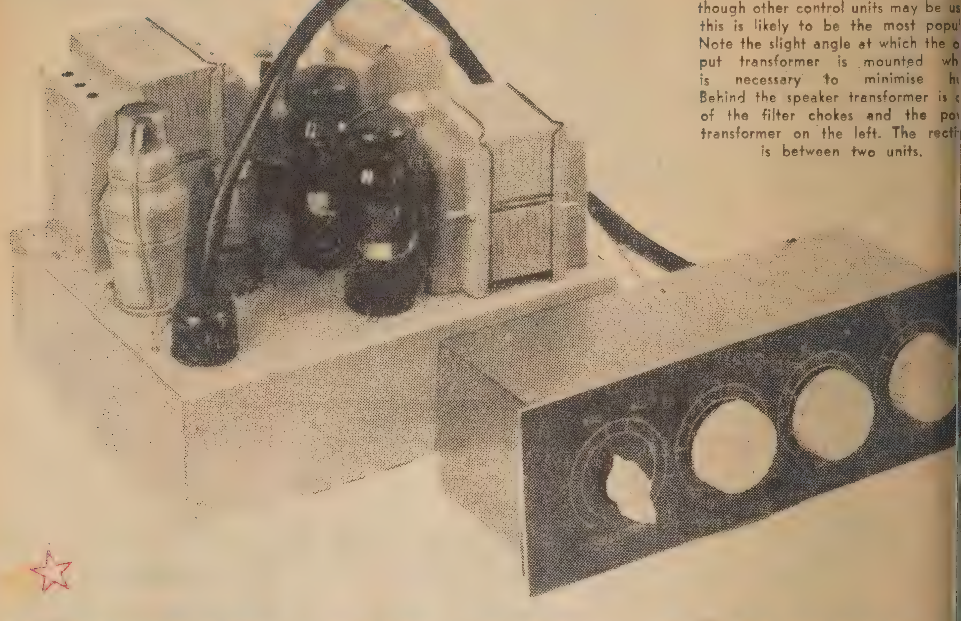


The rebuilt amplifier with the crys Pickup (No. 7) Control Unit. though other control units may be us this is likely to be the most popu Note the slight angle at which the o put transformer is mounted wh is necessary to minimise h Behind the speaker transformer is o of the filter chokes and the po transformer on the left. The recti is between two units.

NEW LIFE FOR OLD AMPLIFIER

Perhaps you're one of the less fortunate readers who, for one reason or another, hasn been able to build up one of our "Playmaster" amplifiers. But don't despair. You can st get some very nice sound into your home by rebuilding and modernising an existing amplifie or, yet again, by building up an amplifier from parts that haven't cost you a great dea

by Philip Watson

NEEDLESS to say, the inspiration for this article came from reader acceptance of recent articles about rebuilding old sets. What you can do with an old set, you can certainly do with an old amplifier.

We're not going to claim here that a rebuilt amplifier is going to rival the performance of our latest "Playmaster", because it won't — in the finer points at least!

There is good reason for this. Miniature, low-noise, high efficiency valves have the edge on the older types, when it comes to circuit design.

OTHER IMPROVEMENTS

Again, modern output transformers, the use of secondary circuit feedback and the introduction of the ultra-linear circuit have all contributed to wider frequency response, better transient response, better damping and lower distortion.

These and other circuit improvements, coupled with the use of better pickups and better speaker systems, have made possible in the home a standard of reproduction which was hitherto attainable only on the most elaborate studio equipment.

However, while this is undoubtedly true, it is equally certain that an old-fashioned amplifier can be brought up to date for very little outlay and its performance considerably improved. In part, this improvement will be within the amplifier itself, due to circuit changes, the replacement of faulty components (electrolytics, old fashioned resistors, &c.) and, possibly a better speaker transformer.

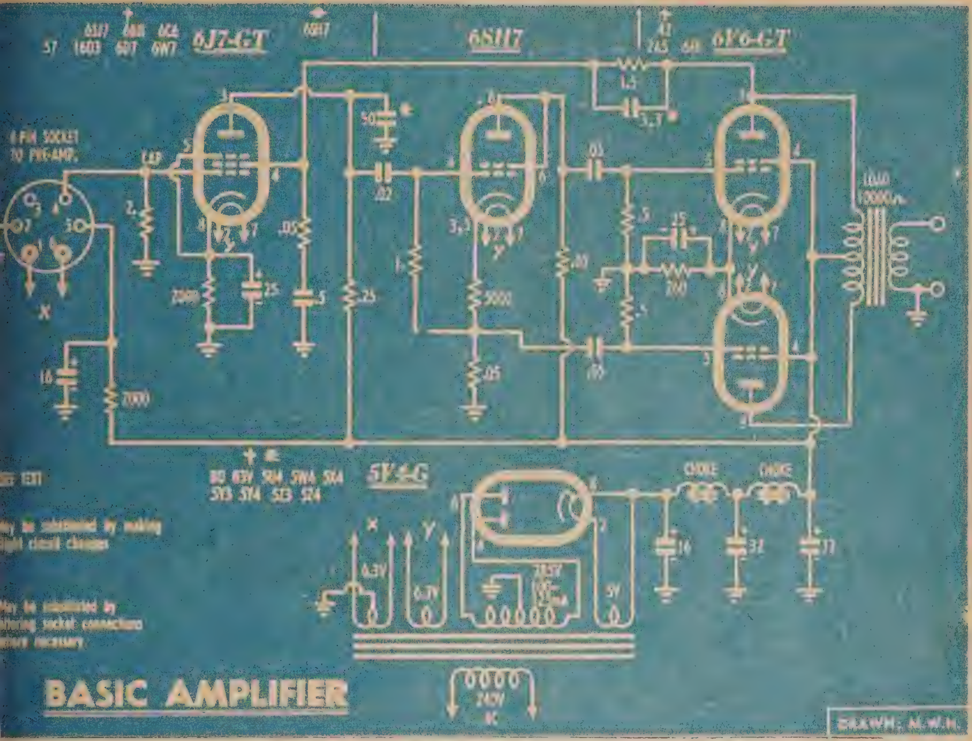
Somewhat less direct, though none the less real, are improvements external to the amplifier proper, such as the use of a control unit (even a simple one) and a better q speaker and we can easily provision for these facilities re-designing the amplifier.

If we look objectively at amplifier made 10 or 12 year we are bound to find that it short of present-day requirer It was, in fact, just such an am which served as a basis fo article.

APPEARANCE

First consideration is the mechanical aspects of appea suitability of chassis size &c. case the old warrior had pler battle scars to show for its and varied roles over the years cuit changes had been made time to time and the origina wiring, of which we were or proud, had gradually given w something essentially function no more.

Add to this the fact tha original hookup wire was of and cotton, and that the rubbe being held in place mainly cotton, and there was a very



ıe circuit is similar to one which was very popular a few years ago, is noted for its simplicity and freedom from problems. ɔte the feedback loop which does not include the output transformer. The two-section filter is necessary, due to the difficulty of providing decoupling for the first stage.

for reefing the "innards" out starting all over again.

ɔmponents above the chassis, as as the chassis itself, had also ɾred from frequent handling. le still sound electrically, chip- paintw.rk, scratches, spots of and solder and suchlike de- ed seriously from their appear-

hile beauty may be only skin ı, most of us like to take pride ur work and produce something :h looks as well as it performs. king with scrappy-looking parts ot very inspiring and only en- ages slipshod work. On the other l it is quite surprising what can done with a brush and some sy lacquer, and it's not hard to e transformers, chokes, &c. look ıally new again.

ı our first step after stripping n was to decide what major ponents could still be used (more ıt this later) and then to clean ı up and give each a coat of t. This also applies to the chassis is still to be used.

V CHASSIS

our case we decided to use a chassis. The original was larger really necessary, besides being e of light gauge aluminium and er flimsy, considering the weight con and copper. it had to sup- A smaller, stronger, steel sis seemed a more logical choice. e chose the Playmaster No. 7. ɘ this seemed most suited to our needs. Admittedly it needed some modification, though nothing that could not be handled by the home constructor. The alternative was a new chassis design, and this seems hardly justified.

This chassis was originally punched for miniature valves and it will be necessary to enlarge these holes to accommodate the older style valves and sockets. In the process their centres may be shifted appreciably to allow for the larger valve envelopes. To show just how this is done we have prepared a drawing of the relevant portion of the chassis, the dotted lines showing the new socket positions.

If you can borrow a socket punch it will be an easy matter to punch new holes in the positions indicated. Otherwise, mark out the boundary of the new hole, drill a series of small holes just inside, knock out the waste material, and clean up with a half-round file.

In regard to the major components which can be salvaged much depends on the components themselves and the amount of money which you wish to spend on new ones. However, on the assumption that an amplifier of this kind would be an economy project, it is reasonable to expect some com-

PARTS LIST

1 Chassis (Playmaster No. 7 June, 1954)
1 Power transformer 385V 80-125 mA
1 Output transformer 10,000 ohms suit speaker.
2 30H Filter chokes

VALVES

1 6J7, 1 6SH7, 2 6V6's. 1 5V4. Or substitutes as suggested. See text.

SOCKETS

1 4 pin miniature. 1 6 pin. 5 Octal. Or to suit valves.

RESISTORS

1 2 meg. ½ W. 1 1.5 meg. 1W. 1 1 meg. ½W. 2 .5 meg. ½W. 1 .25 meg. 1W. 2 .05 meg. 1W. 1 .05 meg. ½W. 2 2000 ohm 1W. 1 260 ohm 1 or 3W.

CAPACITORS

2 32 mfd 350V electro. 2 25 mfd 25V electro. 1 16 mfd 600V electro. 1 16mfd 350V electro. 1 .5 mfd 200V paper. 2 .05 mfd 400V paper. 1 .02 mfd 400V paper. 1 50 pf mica (See text)
1 3.3 pf mica or ceramic.

MISCELLANEOUS

Shield for 6J7. 2 8 tag term. strips. 2 5 tag term. strips. 1 7 tag term. strip. Grommets, nuts and bolts, tinned copper wire, hook-up wire, shielded wire, grid clips &c.

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3490P	90 volt Miniature "B" Battery	2-21/32	1-29/32	3-13/16	24/9 ea.
3490	90 volt (Portable) "B" Battery	3-23/32	1-3/8	3-45/64	24/9 ea.
3719	7½ volt Portable "A" Battery	4	2-11/16	3-3/8	8/2 ea.
3739	9 volt Portable "A" Battery	8-17/32	1-3/8	3-13/16	10/3 ea.
3741	1½ volt Portable "A" Battery	5-1/16	2-1/2	4-5/16	11/4 ea.
3742	1½ volt Portable "A" Battery	2-9/16	2-9/16	4½	7/3 ea.
3745	1½ volt Portable "A" Battery	3-7/8	1-7/16	10-13/16	11/- ea.
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3761	4½ volt Heavy Duty Bias Battery	4	1-5/16	3-3/8	3/5 ea.
3762	45 volt Portable "B" Battery	4-3/8	2-1/2	5-7/8	18/9 ea.
3765	9 volt Portable "A" Battery	3-1/4	2-11/16	4-1/16	10/3 ea.
3770	45 volt Plug-in "B" Battery	8	4	7-7/16	34/6 ea.
3793	9 volt Light Duty Bias Battery	5	7/8	3	5/- ea.
X250	1½ volt Plug-in "A" Battery	8-1/4	4-1/8	6-1/8	34/- ea.
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3935	1½ volt Round Unit Cell	15/16 dia. x 1-15/16 high			1/1 ea
3950	1½ volt Round Unit Cell	1-5/16 diam. x 2-3/8 high			1/2 ea.
32015	3 volt Round Battery	7/8 dia. x 4-1/2 high			1/9 ea.

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ise between cost and per-ance.

e most critical component is ubtedly the output transformer. ly it should be one of the better ty types with plenty of iron copper, rather than the "pip k" types normally supplied the cheaper loudspeakers.

is possible that the original ifier used one of the former, ich case it should still suit. The point to query is whether its dary impedance is suited to of the better quality speakers, you may be contemplating.

uming it checks all right on point, almost any of the older quality types should suit.

ning further down the scale we the larger transformers made e speaker manufacturers. Al-h not as good (or as expen- as the previous type they are od deal better than the very ones and good enough for an fier of this type, if you do not disposed to invest in anything expensive for the time being.

LE FEEDBACK

make possible the use of as a range of transformers as le we have deliberately used lder type of feedback circuit does not include the trans-r within its loop. Although ffective than the more elaborate ts, it is also less critical; in it is virtually impossible to trouble from this source.

t, the power transformer. y this should be a 285 volt nA type, but other sizes could ed. The amplifier itself draws 70 mA or so and it would be le to use an 80 mA type with control units, but on the as-tion that a tuner was not to ed.

the other hand a larger rating, as a 125 mA type, would be satisfactory and the margin ded would be all to the good.

her voltage types, such as the 85-volt" standard, can also be with small circuit modifica- They were generally used the old electro-dynamic ers, having a field coil resist- of about 1000 ohms or so. In cases a speaker of this type lso be available.

USEFUL

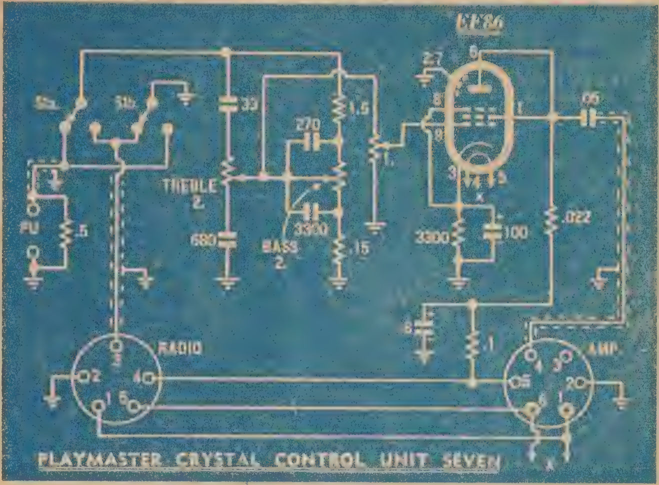
uming it is in a satisfactory ion and its standard of per-nce meets your requirements, is no reason why it should not ed. By using its field in place e SECOND filter choke and ps also substituting a 5Y3 for V4 it should be possible to a correct HT voltage.

rnatively, if it is desired to permag speaker, one choke need be used and the other ed with a resistor of 1000 0 ohms. The resistor should e of the heavy duty 20 watt y.

in, the two chokes may be re- and a smaller dropping re- fitted between the rectifier le and the first filter capacitor. resistance will be required in position to provide a given voltage reduction, probably about half that required elsewhere in the line.

The only other point to watch is that the transformer filament windings have sufficient rating to carry whatever control unit and tuner it is intended to use. This should normally be so.

FOR USE AHEAD OF AMPLIFIER



Since a crystal pickup is the most likely type to be used with this amplifier, the No. 7 Control Unit is the most logical choice. Other types can be used if a low output magnetic pickup is contemplated.

MINOR COMPONENTS

The minor components also warrant some consideration. Most of the resistors should be perfectly satisfactory but it is a good idea, while they are out of circuit, to check each one with an ohm-meter or, better still, a bridge. Any which are more than the normal 10 pc out of tolerance should be replaced.

The paper capacitors could also be checked with advantage. Leakage is the main worry here and a neon tester will quickly reveal any that are below par. Good insulation is particularly important in the case of coupling capacitors.

The electrolytics, both filter and cathode by-pass, are in a somewhat different category. For one thing, any electrolytic as old as an amplifier of this type is due to be pensioned off. It will most certainly have several "mfd's" less than when it was new and can seriously prejudice performance.

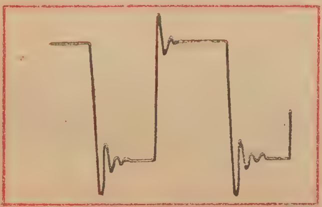
Again, there has been much improvement in electrolytic manufacture since the days of our old amplifier and current practice is to use something like twice the values of those days. Even so these are still smaller physically than the older types. In a circuit where good filtering is very desirable, the highest practical values should be used.

This applies less to the cathode units than it does to the filters, but new ones all round is a good idea. The saving of space still applies and can be quite useful.

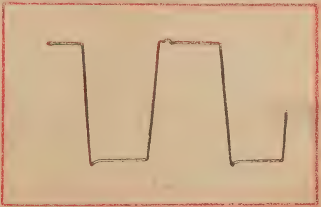
POSSIBLE VALVES

As indicated on the circuit there are quite a number of valves which can be used in place of the main types shown. Of the types shown to replace the 6J7 the 6SH7 only will need circuit alterations. For this valve the screen resistor should be reduced to .56 meg and the bias resistor to 1100 ohms.

This will have the effect of increasing the feedback but it will be offset partly by the higher gain of



A really bad case of ringing! A 5Kc square wave as it appeared across the transformer primary before we by-passed the plate of the 6J7.



A 50 pf 6J7 plate by-pass was enough to produce this result in the primary circuit, but the 3.3 pf feedback by-pass was necessary in addition to counter ringing in the secondary circuit.

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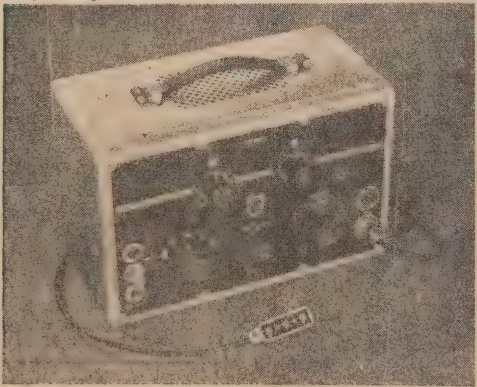

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s valve. Though we didn't actu- y wire a 6SH7 into circuit, a istor of about 25,000 ohms should about right between the screen l its bypass.

he 57 is a 2.5 volt version of the ; and will require a suitable fila- nt winding. The 1603 is a low se version of the 6J7, while the tode section of the 6B8 is also ilar to the 6J7. The remainder e minor differences but not ficient to justify circuit changes. should be sufficient to provide table sockets and appropriate nections.

he phase changer is not at all ical and can be any triode or de-connected pentode. We sug- t the 6SH7 because these have n readily available through dis- als at a very low price. The gle-ended construction saves hav- to worry about the grid-cap nection.

ITPUT VALVES

he 6V6's will almost certainly the most popular for the output ge, but certain older types can used if they are on hand. The 5, 42, and 6F6 are all identical ctrically, except that the 2A5 is .5 volt version. The bias resistor the 6V6's happens to work out rectly for these valves and the d, 10,000 ohms, is also so close t there is little point in changing

here is quite a wide range of tifiers which might be available. ne are local types, some overseas es which have been won from posals gear. All will work, but HT voltage will vary consider- y in some cases. A lower HT tage is serious only in so far as it luces the available power output. higher voltage may run the valves o the overload region with serious rtening of life.

Where two chokes are used, having esistance of about 150 ohms each, 5V4 will deliver a total HT volt- e approaching 300 when only a trol unit is used. After allowing bias this will permit operation of 6V6's very close to the recom- nded maximum conditions for ss AB1. The 83V is electrically ntical and the 5Z4 also very ilar.

he 5Y3 will drop the voltage con- erably, probably to 250 volts, and s will necessitate reducing the 6 bias resistor to 200 ohms if ximum power output is to be ained. The 80, of course, is ctrically identical. Somewhat ilar performance can be expected m the 5Y4, the voltage probably ng a trifle higher.

DWAY

Next we have the 5U4, 5X4, and 3, being electrically identical but h differing bases and basing con- ctions. They will give a voltage ermediate between the 5Y3 and 5V4 with their respective unterparts.

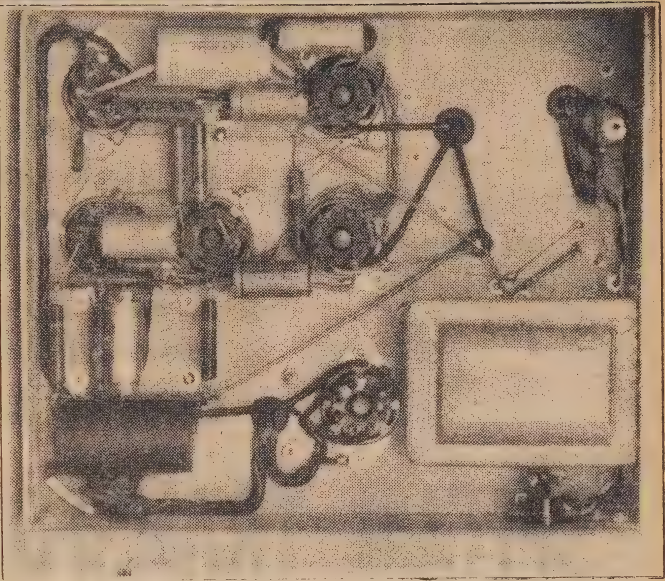
he main precaution, as already ntioned, is to avoid the use of the 4 or its equivalents with a 385 nsformer and field coil arrange- nt of around 1000 ohms. The ult would almost certainly be an essive HT voltage. It would essitate connecting resistors of out 150 ohms 3W in series with h plate lead to the 5V4.

The circuit is a perfectly standard one which was quite popular a few years ago. Its main feature is the simple feedback circuit, whereby the screen of the driver stage is fed from the plate of one output valve and a voltage divider at audio frequencies sets the amount of feedback. (Note that it must be the output valve fed from the phase splitter plate.)

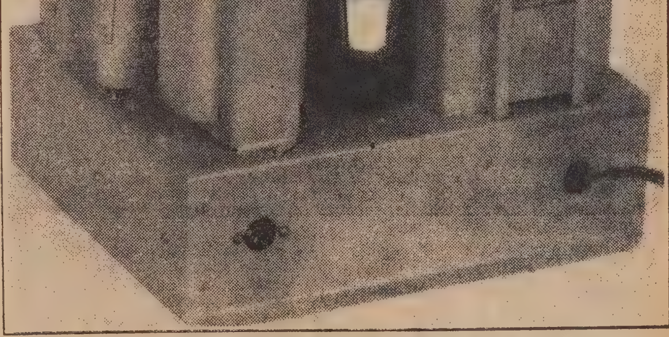
By deliberately excluding the output transformer from the feedback loop, we avoid most of the complications caused by phase rotation in all but the more expensive types. Admittedly we also sacrifice the advantages provided by including the transformer in the loop, thereby correcting in part any deficiencies of the transformer.

Even so, feedback cannot correct limited bass output &c., imposed by a lack of iron and copper in the transformer's basic design.

TWO VIEWS OF REBUILT AMPLIFIER



As this underchassis shot shows it is quite possible to arrive at a neat layout using the smaller chassis and old style components. Input socket is top left, the 6J7 below it, 6SH7 to the right, and the 6V6's top centre. Note the extra filter choke.



A rear view of the amplifier. The power transformer is on the right, one of the chokes on the left, and the output transformer behind it. The speaker socket is below the choke.

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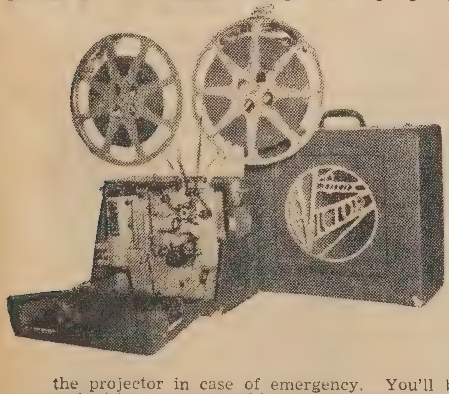

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Another disadvantage is the fact t the screen is fed from a point ich may contain considerable ple. In the normal way we would ouple the screen and plate supply the first valve providing, quite ply, the additional filtering this t of the circuit requires. Unfor- ately, decoupling is out in a cir- t like this, because the screen uit must contain the audio signals d to provide feedback.

'his is the reason we provide a ible section filter and use the hest values of capacitance pos- le. Fortunately, such an arrange- nt gives good results, even if, on er at least, the hum level is her than we can achieve with the ymaster circuits.

very interesting point about the uit is the 50 pf by-pass from the te of the 6J7 and the 3.3 pf across 1.5 meg feedback resistor.

n the days when this amplifier s contrived it was discovered that plate by-pass was desirable for ble operation. It seemed to make amplifier more docile and tended give "cleaner" reproduction. In absence of more specific details vas simply included in the circuit a matter of course.

IE AND SQUARE

Vhen we came to test this amplifier made an interesting observation. waveform, measured across the nsformer primary, appeared to be te satisfactory while only a sine ve was involved, even without ier of these refinements. How- r, switching to square waves told ery different story, the resulting tern being a classic example of ging. A tracing of it is repro- ed herewith.

t this stage the fitting of the 50 plate by-pass appeared to be all was necessary to give a near- fect square wave, as shown in other diagram. Subsequent cking, however, showed that the ging in the transformer secondary s still bad and that the plate by- s was only effecting a partial e.

larger by-pass would have re- ed the ringing but only at the ense of treble response. As an rnative, we tried increasing the dback at the higher frequencies by by-passing the feedback resistor with a small capacitor. Due to the high resistor value only a very small amount of capacitance was necessary and it did a most effective job without serious treble loss.

This by-pass may need to be modified in value according to the type of output transformer used, but in the absence of suitable testing gear a value between 3 and 5 pf should be satisfactory.

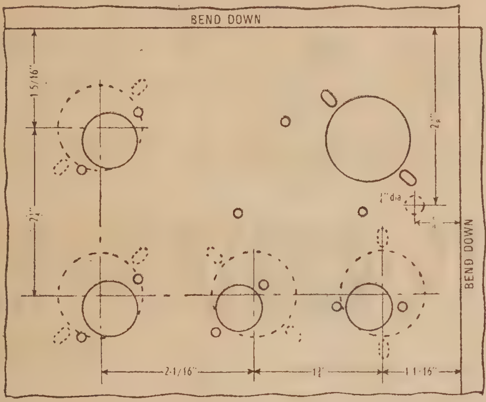
Thus was pinpointed the mysterious "something" which stimulated the ear yet eluded the test procedures of those days—surely a point in favor of square wave testing if ever there was one!

Next the actual construction.

☆

w to modify the 7 Playmaster ssis to take the jer valves. The a spacing will w the old style " envelopes to accommodated necessary. The holes may be ched or drilled and filed.

☆



Assuming a satisfactory chassis as already discussed, the first thing to do is to mount the major components. The photographs give a good idea of the general layout but the positioning of the output transformer is quite critical.

This is best placed so that the magnetic coupling to the power transformer is minimum, otherwise 50 cps hum may be troublesome. The best position can only be found experimentally and the first thing to do is to mount the power transformer in the position it is to occupy. Make sure the loose leads are protected and connect the primary to the mains. Now sit the output transformer in the approximate position it is to occupy, connect it to some suitable indicator and rotate until hum pickup is at a minimum.

The best indicator is probably a CRO connected across the primary winding but if this is not available a well baffled speaker connected to the secondary will do. Alternatively the signals may be fed to another amplifier to make them more easily discernible.

FINAL MOUNTING

When the best position has been found check that it will not foul any other components before finally drilling the mounting holes. Also drill 3/8in lead holes and fit with grommets before mounting the transformer.

In mounting the filter choke beneath the chassis make sure that enough room is left for the speaker socket to be mounted on the rear of the chassis. Solder leads to the

(Continued on Page 99)

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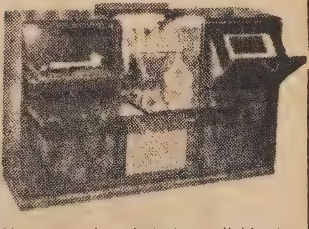

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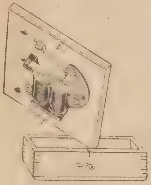

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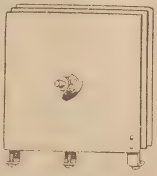

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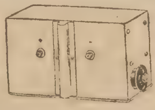

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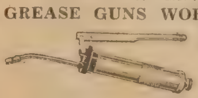

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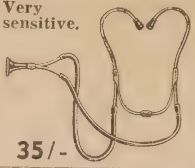

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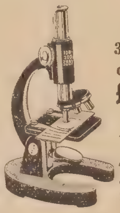

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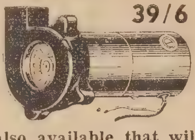

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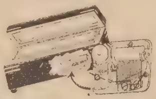

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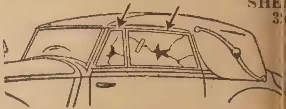

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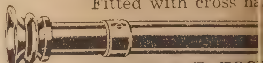

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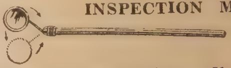

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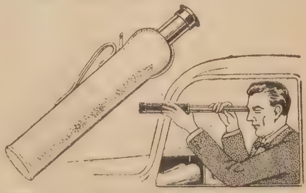


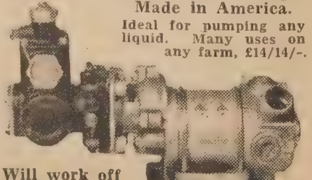
TELESCOPE

SPECIAL OFFER

NEVER BEFORE AT THIS PRICI
EVERY MOTORIST should carr
one. Ideal for Farmers, Natural
ists, Shooters, etc. In Pigski
Leather Carrying Case.
20 Magnifications £5/5/

AIRCRAFT 24 volts Motor complete with 400 gal. per hour Pump. Made in America.

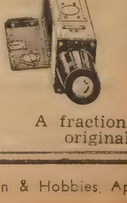
Ideal for pumping any liquid. Many uses on any farm, £14/14/-.



Will work off any 32 volt lighting plant.
Pump only, 55/-.

RAAF 16MM MOVIE CAMER
Complete with Cassette Fi
Holder.

£6/6/-



3.5
Lens

A fraction of th
original cost.

STORES

512 Elizabeth St., Melbourne, C.1.
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d Efficiently Despatched
Include State in Address.

A FEW ONLY
BE EARLY
ARMY TELEPHONES

Ideal operation from farm to farm reception Same as P.M.G. phone. Will operate up to 20 miles.

£4/19/6 EACH.

BINOCULARS BINOCULARS

£5 Allowance on your Old Glasses

Here is your opportunity to dispose of those old opera or out of date field glasses regardless of their condition as part payment on a modern pair of 7 x 50 or 10 x 50 high powered pair of binoculars as used by the broadcasters. These glasses are complete with a genuine pigskin case and are priced at the amazingly low figure of £23/15/- for 7 x 50 or £25/15/- for 10 x 50. There is no catch in this offer. These binoculars are brand new and are of the finest quality. Don't miss this opportunity. Remember the Olympic Games are to be held in less than 12 months' time. Just mail old glasses to us with your remittance for your £18/5/- or £20/15/- for the extra high powered 10 x 50, plus 8/- extra for reg. post.

EL ARMY TANK AERIAL ODS WILL MAKE IDEAL RADIO AERIALS FOR CARS OR TRUCKS

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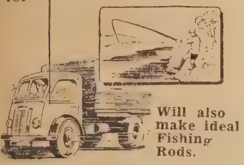
Will also make ideal Fishing Rods.

long, 3 sections. Each section 22/6. 8ft long, 2 sections 15/-.

GLISH SMITH 8-DAY CLOCKS

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the
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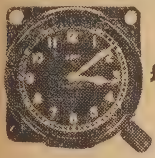

Luminous Dial

£5/15/-

Makes ideal car clock

ed with Sweep Second Hand. Ideal for any car or truck.

rand new American Wobble Pump, semi-rotary.

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tinuous
c',
3 9/6.
d for caravans, emptying or filling
l tanks watertanks, etc.

R.A.F. LEATHER FLYING HELMETS, 50/- each.

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LES 70/-

MK7 Goggles 37/6 Pair.
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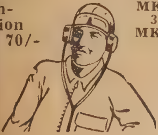
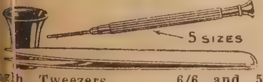


WOOL LINED FLYING BOOTS.
£5/19/6 pr

HUGE PURCHASE
Waterproof Flying Suits.
Special Price £4/7/6.

Dalton Computors in good working order, 45/-.

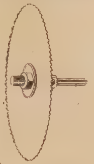
WATCHMAKERS AND INSTRUMENT MAKERS



gh Tweezers	6/6 and 5/6
sses	6/6 and 8/6
strong double lens Eyeglasses	15/-
drivers set of five	13/9

4¼in SAW BLADES COMPLETE WITH ARBOR

22/6
Complete.



Ideal for Electric Drills.

Make your own Hobby Saw Bench.

Special Disposals Meter Offer

Eng. 0-30 Amps 2¼in DC	32/6
0-3 amp meters, AC-DC, 2¼in dial	45/-
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Weston 0-50 Milliamps 2½in	27/6
English 50-0-50 Ammeters M/Coil	37/6
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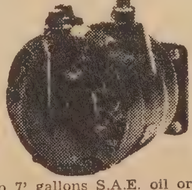
English 0-40 Voltmeter, M/Coil	25/-
English 0-300 AC-DC Voltmeters	55/-
English 0-5 Milliammeters, 2¼in	27/6
English 0-10 Ammeters, 2¼in dial Moving Coil	45/-
English 0-50 Voltmeters, 2½in dial, AC-DC	42/-
English 0-40 Ammeters, 2½in dial, AC-DC	42/-
English 0-30 Ammeters, 2¼in dial, AC-DC	45/-
English 0-14 amps AC-DC 4½in dial	59/6
Eng. 0-20 amps, 2in dial, M/c	25/-
Eng. 0-200 Ammeter, M/coil	£4/10/-
Eng. 20-0-20 Ammeters, M/coil	37/6
Eng 0-30 Amps AC-DC 2¾in dial,	42/-
Eng. 0-50 Amps AC-DC 3¾in dial,	75/-
Eng. 0-80 Amps AC-DC 3¾in dial,	75/-
Eng. 0-1 Amps DC 2¼in dial	35/-
Eng. 200 Amps AC-DC 3¼in	£4/19/6
Eng. 0-5 Amps AC-DC 2¼in	45/-
Eng. 0-150 Milliamps 2¼in DC	27/6
Eng. 0-500 Microamps 3½in DC	50/-
Eng. 0-6 Amps 3½in DC	25/-
Eng. 0-25 Volts 2¼in DC	22/6
Eng. Ohmmeter reads 0-60 M.Amps. 0-500 ohms, 0-15 volts, 0-3 volts 3in dial	45/-

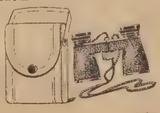
VACUUM or AIR PUMP



Builds up air pressure to 20lb at 1000 R.P.M. develops up to 120lb of hydraulic pressure, will pump 7' gallons S.A.E. oil or other liquids per minute. Useful for spraying, milking presses, oil burners, hydraulic systems, £3/10/-.

BINOCULARS, BRAND NEW VERY POWERFUL

Complete in solid pig-skin leather case.



£7/15/-

Fitted with High Class Ground Lenses.

SPECIAL OFFERS

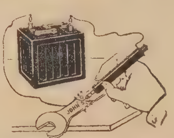
Genemotors, 12 volt input, 250 volt output 70 mills. 57/6

American Shrader tyre pumps, work from your spark plugs, 39/6. Car type fire extinguisher. Every car should carry one. Cost £7/10/-, £4/10/-. Brand new 7/8in spark plugs, suit most old type cars, 2/6, or ideal for tractors. Army steel tow ropes, looped ends, 17/6. S.A.E. open end spanners, 6 to set, 24/6. Whitworth, 4 to set, 18/6. German Army marching compasses, work similar to prismatic, 32/6. Magnifying Glasses, 8 mags., 8/6. 10 magnifications, 12/6. 24 volt motor and hydraulic pump, capacity 3½ gals, per minute, £3/15/-. New headphones suitable for crystal sets, 17/6 pair. Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, 39/6.

R.A.F. BOMB HOISTS

33 to 1 ratio. Heavy construction. Ideal for adapting for garage work, lifting engines, etc. **£10/15/-**

AT LAST THAT ELECTRIC ENGRAVER THAT WORKS OFF ANY 6 OR 12 VOLT CAR BATTERY



29/6

Complete with Instructions.

Engrave your own tools, name plates, dog collars, cutlery, watch cases, cigarette cases, etc. Engraved articles are never stolen.
Agents wanted for Interstate and all country Towns. Write for details

At last the spotlight you have been waiting for

Fitted with genuine American sealed beam globes. No motorist or boat owner should be without one,

Ideal for Fox or Rabbit Shooting.

6 Volt, 90/-; 12 Volt, 95/-.
Complete with Switch and Flex

MANUFACTURERS
OF COMMERCIAL
RADIO RECEIVERS
FOR 14 YEARS

CLASSIC RADIO

FOR QUALITY
FOR ECONOMY

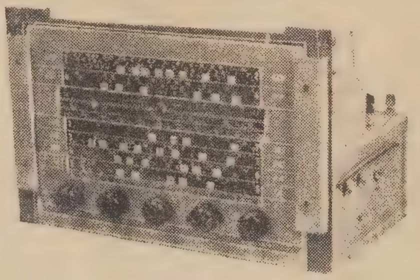
HI. FI.

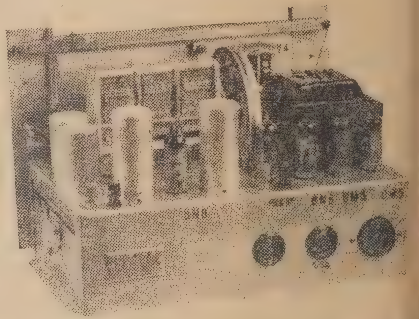
BEFORE PURCHASING YOUR RADIO SEE AND HEAR THE NEW RANGE OF HIGH FIDELITY CHASSIS BY CLASSIC INCORPORATING THE MULLARD 5/10 AUDIO AMPLIFIER CIRCUIT.

Compare these new features of our Hi-Fi nine valve D.W. radiogram chassis with dual triconed speakers and separate bass and treble boost.

Priced at **£39/15/-** F.O.R.

Frequency Response 40 to 13,000 Cycles — Max. Output 10 Watts.





- **NEW** ● Ultra modern circuit using nine high gain valves including "magic eye" tuning indicator. Perma-tuned iron cored coils and intermediates giving excellent interstate reception and a short wave range of 12,000 miles. All valves used are the new Philips nine pin innoval series.
- **NEW** ● Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving + or — 15db. boost or cut at 50 cycles L.F. and 10,000 cycles H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favorite recordings.
- **NEW** ● Dual speaker combination using a heavy duty woofer (12in M.S.P. Jensen AU54 special) with matching 6in tweeter and cross-over network giving a frequency response of 46 to 13,000 cycles. Speakers are mounted coaxially making only one 11in mounting hole necessary. If required the new Magnavox high fidelity twin coned speaker can be supplied.
- **NEW** ● Large calibrated edge-lit dial in perspex (11in x 7in) with main stations of each State in prominent type. Dial fitted with counterweight drive giving smooth tuning. Indicator lights are fitted showing which band is in operation. Dial can be supplied in cream or brown with matching knobs and escutcheon to suit blond or walnut finished cabinets.
- **NEW** ● Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.

All chassis are wired for the fitting of an F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and three-pin outlet for gramo. motor.
Power switch is fitted to volume control, radiogram switch combined with wave change switch. Audio end of set can be used with T.V. receiver if required.

ALL CHASSIS GUARANTEED FOR A PERIOD OF 6 MONTHS

A New 10-Valve Dual-Wave Radiogram Chassis

WITH BASS AND TREBLE BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

£42/15/
F.O.R.

Owing to sales tax increase we regret the necessity of increasing chassis prices.

RECORD PLAYERS AND CHANGERS

We have a complete range of 3-speed record playing equipment, including Dual, Collaro or Garrard Players, with turn-over crystal pick-ups or your choice of Garrard, Stromberg-Carlson, Collaro or the new Dual 3-speed changer that will play 7, 10 or 12in record intermixed. All changers have turn-over Crystal pick-ups.

CLASSIC RADIO

245 Parramatta Rd.,
Haberfield, N.S.W.
Phone UA2145

FROM THE SERVICEMAN WHO TELLS

Where servicemen gather these days, the discussion turns inevitably to television. Perhaps t's little wonder, because its advent is likely to work a major revolution in our ranks. A few remarks here, therefore, may not be out of order.

AN well remember about ten
years ago, as we faced the
war" era, thinking that it
d only be a matter of time
e we'd also be facing the "tele-
n" era in Australia.
wever, so many other things
priority just then that I, like
other servicemen, merely
gged off television as a com-
tion that we'd have to worry
somewhere in the dim future.
replaced some of the old test
and settled down to the routine
placing dud electros and such
There was never any lack of
s to do.

COMING"

en, suddenly, there came the
stion from Government circles
television could be got under
fairly soon, with transmitters in
capital city. This caused quite
ap around the radio trade,
the realisation that everyone
the executives down would
to start right in and learn
hing about the game.
government policy changed
the scheme was shelved.
v!"
it was somewhere before 1950,
remember rightly and I recall
s. Moyle and Williams hold-
moist finger in the wind and
incing sagely that we wouldn't
television now until 1956 at
arliest!
it seemed to be an age away
while I didn't see how tele-
could possibly be delayed as
as that, their remarks at least
ded sufficient excuse to relax
again. (More dud electros, &c.).
Vether the said gentlemen were
ically very astute, psychic, or
plain lucky, I don't know but
has arrived and so has tele-
. . . almost.
n, at this late stage, there
st seem to be any chance of
her reprieve, short of a politic-
upheaval, a technical revolution
a hird world war.

O TELEVISION . . .

o to television, with all its
bms and worries.
n only apologise if my accept-
e of the position seems a little
t-of-fact; if I seem to reflect
me enthusiasm as the groom
hot-gun wedding!
be too many intermittents
e got me down.
eusly, though, television is go-
be a worry for everyone of
in the retail and service busi-
s. It's likely to make or break
ccording to whether we rise
h occasion or just try to muddle
oun.
alk means anything, the ser-
in game is not lacking in ex-
pl of both approaches. I've
of some chaps who are all set
d' their savings on new shop-
new signs and a benchful of expensive gear that looks the part—even if they don't know yet how to work it.

On the other hand, there are plenty of chaps who are too busy or too tired or too something to take any real action about TV servicing. They seem to be working on the premise that it will be time enough to worry when the first television set is pushed over the counter at them.

Then presumably, they'll either fix it or it will fix them!

To me, this last named attitude reflects the same order of sagacity as that attributable to the ostrich, with his supposed habit of burying his head in the sand.

TV sets involve so many new techniques that it's no earthly use just shaping up to one with a screwdriver and a determined look on one's face.

Nor is there any future in dodging TV servicing. People who have to patronise a particular establishment for television service tend, automatically to take their radio and electrical problems to the same place. At least, I'm told that that's the way it is overseas.

There's the vague implication, as well, that a serviceman who won't tackle a TV set can't know too much about the game.

Up to a few months ago, there seemed to be a feeling around the trade that the average Australian radio serviceman would not be able to cope with the intricacies of a television set; that a complete new generation of servicemen would have to be trained.

It was commonly agreed that all servicing would have to be concentrated in a Service Department attached to the parent factory—at least for the first few years.

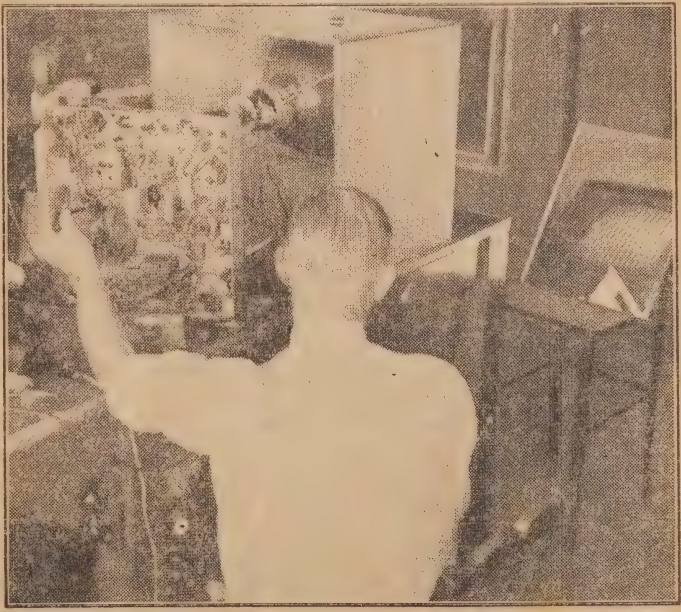
CHANGED ATTITUDE

Now the attitude seems to have changed and manufacturers are looking to us serviceman, in no uncertain manner, to keep their television sets going.

Perhaps they have reasoned that Australian servicemen are no less resourceful than their English and American counterparts. Perhaps they anticipate enough trouble finding personnel to build and test the receivers, without having to keep them in order as well.

Perhaps it's just the obvious and accepted way of doing things.

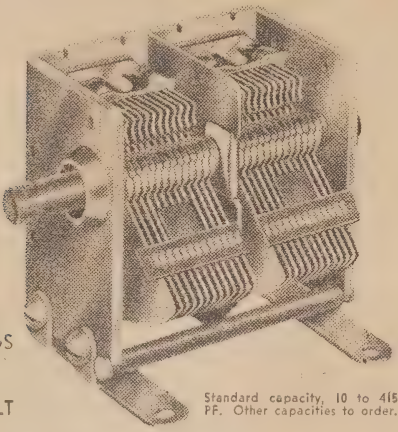
Whatever the explanation, the ball looks like landing in the serviceman's court and we'll either have



An AWA engineer tests a prototype TV receiver using a mirror to reflect the bar pattern on the tube face. Not long hence this scene may have to be duplicated on many local service benches.

ROBLAN... *Australia's Own Miniature Gan variable condenser*

Approx. Actual Size, RMG2



Standard capacity, 10 to 415 PF. Other capacities to order.

ROBLAN GANGS
ARE
PRECISION BUILT

GANGS	MODEL	PRICE
Single	RMG1	18s. 7d.
Two	RMG2	26s. 3d.
Three	RMG3	34s.

With in-built Planetary 4-1 reduction drive:

Two	RMG2V	31s. 4d.
Three	RMG3V	39s.

Suitable dial-scales for these two models also available.

Rigid aluminium plates, non-microphonic in confined units.

"NOTE.—Prices quoted above are now subject to increased rate of Sales Tax."

FROM RADIO STORES EVERYWHERE

Sole Distributors: WATKIN WYNNE PTY. LIMITED, North Sydney. Represented in all States.

CRYSTAL INSERTS

ZEPHYR

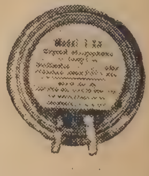
TO MEET THE AUSTRALIAN USERS' REQUIREMENTS

MODEL 1XA — with Zephyrfil Sintered Filter — Aluminium diaphragm—fully protected crystal.
60-6500cps—45db Grid 1—5 meg load.

MODEL 6XA — with protected aluminium diaphragm — patented crystal unit
70-7000cps—38db Grid 1—5 meg load.

MODEL 11XA — with Zephyrfil Sintered Filter — Aluminium diaphragm —
55-8000cps — 40db Grid 1—5 meg load.

ALL UNITS FITTED WITH REAR HUM SHIELDS



RETAIL PRICES

1XA	**45/9 ea.**
6XA	**29/7 ea.**
11XA	**38/6 ea.**

Stocked by leading wholesalers in each State

ZEPHYR PRODUCTS PTY. LTD.

**PHONE
BL1300**

58 HIGH ST., GLEN IRIS, SE6, VIC.

make the right play or suffer the nsequences.

Fortunately, there's no need to nic, because time is still on the e of servicemen—but only just

Though there is talk of having ograms on the air by about Nonber, it doesn't mean that seremen will suddenly find themves engulfed by faulty television s by the middle of that same nth.

O IMMEDIATE RUSH

The immediate supply of sets will limited by manufacturing facilis, import restrictions and so on. o, their price will be such as encourage a "wait-and-see" attie on the part of many prostive buyers.

All in all, I think it will take te a few months for a signifit number of television sets to pear in any given serviceman's rritory".

Then there's another thing. Those t sets will be watched very carely by their manufacturers to det any incipient faults, before they built into too many more like eivers.

The local serviceman's problems y not really start until manufacers have begun to lose interest their first efforts.

Even after that a serviceman ght be able to avoid the issue a while—if he wants to—so that might be the end of next year ore he begins to acquire the utation of a man who can or n't, or will or won't, fix television eivers.

Personally, I'm not going to leave till then to find out what makes evision tick. I don't like living borrowed time.

For the past few month I've been shing up on fundamentals. To sure, it might seem infra dig. a hoary headed serviceman to reading an elementary textbook it's surprising just how many damental facts one forgets over years.

CTS "CLICK"

And it's surprising, too how much der the facts "click" after years practical servicing.

A head full of fundamentals, nicebrushed up and sorted out, is best possible equipment with ch to start reading a textbook on vision.

ve been reading some of those with varying degrees of sucs. Most of them are wedded he British system or the Amerisystem and it takes some contration to sort out the variations practice and/or to remember that tralian standards are different in from either of them.

owever, it's all good mental exer and, even though part of it nt read like the proverbial tch" at first encounter, at least e of it will stick.

fter all, if you stand out in the long enough, you're sure to get !

espite all this, however, I still at a television set (the few times, I've seen one) with the e lack of comprehension as I inside a telephone exchange. Sure, I know how a telephone works but I haven't a clue how the mechanics sort out those great bundles of wires and thousands of lugs.

But then I've never worked as a telephone mechanic!

However, given a few days in such a place, with the requisite instruction, charts and what-have-you, I guess it would look a lot less mysterious. One would even know in which direction to walk to start looking for a fault.

That's the way I'm hoping it will be with me — and television. I'll fill the old noodle up as best I can with "theory" so that I can make good use of any time available for "practical" training.

"Next time you strike an intermittent fault, it'd be a good idea if you called me a bit sooner" (Radio-Electronics)

Set manufacturers — or at least some of them — have already announced plans for training servicemen to work on their particular brand of sets. Some are sponsoring courses spread over a period of time, others seem to favor an intensive fulltime "cramming" process lasting over a week or so.

Convenience and eligibility will play some part in choosing between such courses but it seems inevitable that servicemen will have to forgo a certain amount of productive and leisure time to take advantage of such opportunities.

PRACTICAL EXPERIENCE

Theory is good, theory is essential, but one simply has to pore over (or should I say paw over) some actual sets before one can develop any degree of familiarity of facility.

Of course, there's the matter of test instruments to be considered, also. Only practical experience will indicate the kind of instruments that one can like, can work and — the most important — can afford.

Some of the prices are pretty frightening when compared with a traditional multimeter, modulated oscillator and such like.

Perhaps the best that can be said is that the whole business of buying and maintaining a television set is more costly than an ordinary broadcast receiver. If the serviceman has to pay more for his gear, he can expect (so I'm told) a higher service fee for an average four visits per set per year.

I can foresee, of course, the need to sharpen up one's powers of debate to justify the increased fees.

Apart from a pattern generator, a VTVM, a CRO and sundry other small items, I'm assured that the well-dressed serviceman will have a portable field strength meter and a portable beam aerial, with which to discover suitable aerial sites atop the customer's roof.

He has to study field strength patterns, locate interference and track down "ghosts", all as part of a day's work.

I'm assuming, of course, that servicemen will have to do an increased amount of installation. You just don't carry a television set into a house, drop a piece of wire down the back and walk out again. It has to be installed with several requirements in mind.

ME—SITING AERIALS

As I handled one of these aerial gadgets the other day, I couldn't help picturing myself, perched on the peak of a tile roof, hanging to the chimney with one hand, holding the aerial array with another, the field strength meter with another and using the remaining one to signal my mate on the ground!

One will either have to develop the propensities of an octopus or take out a fat sick-and-accident policy! I guess Mrs. Serviceman will have something to say about this.

Mrs. Serviceman might also be concerned about the financial side of the business, which is tied up rather closely with one's technical ability.

I understand that the most progressive dealers overseas are those who can assume full responsibility for a television set, from the moment it leaves the parent factory.

They attract the prospective customer by suitable display and advertising. The moment the said customer shows the appropriate interest, they whip the set into the home, put up a suitable aerial and have the thing ready and working while the interest is still hot.

It's easy enough then, to have the customer sign on the dotted line.

Should something go wrong with the set, there's no delay. The dealer either sends the serviceman or goes himself, if he happens to be the one and same person.

It's the same set-up as for ordinary broadcast receivers and it depends entirely on the ability of the local dealer-cum-serviceman to handle all the installation and service problems.

The alternative is for the local dealer to act purely as a selling agent. For a much smaller discount margin, he contacts the customer, accepts the deposit and passes the details in to the manufacturer or his agency.

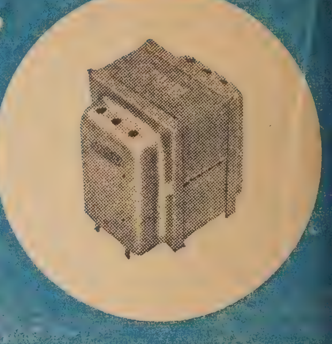
NO PERSONAL CONTACT

The customer thereafter becomes a name on a big list and the dealer can only make excuses for any delay which might ensue.

Dealers-cum-servicemen who don't face up to the technical challenge of TV may easily find themselves stuck permanently with such a position.

But where on earth am I getting to? I started out to make a few general remarks about televisaion servicing and ended up with dealer discounts! But perhaps a rambling

Ferguson



PREFERRED TRANSFORMER RANGE

POWER TRANSFORMERS FIRST PREFERENCE

CODE NO	PRIMARY VOLTS	HTV Aside	HT MA	FILAMENTS
PF 130	230-240	285	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 130F	230-240	285	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 151	230-240	285	60	6.3V/2A 5V/2A
PF 151F	230-240	285	60	6.3V/2A 5V/2A
PF 152	230-240	285	125	6.3VCT/2A 6.3V/2A 5V/2A
PF 165	230-240	385	60	6.3V/2A 5V/2A
PF 170	230-240	285	80	6.3V/2A 6.3V/2A 5V/2A
PF 185	240	150	30	6.3V/2A
PF 201	240	225	50	6.3V/2A
PF 265	230-240	Secondary Volts		1V TAP 11.5, 10, 8.5/4.2A
PF 299	240	285	40	6.3V/2A 5V/2A

POWER TRANSFORMERS SECOND PREFERENCE

CODE NO.	PRIMARY VOLTS	HTV ASIDE	H.T. MA	FILAMENTS
PF 160	230-240	385	100	6.3V/2.5A 6.3V/2.5A 5V/2A
PF 164	230-240	325	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 166	230-240	325	60	6.3V/2A 5V/2A
PF 168	230-240	385	80	6.3V/2A 6.3V/2A 5V/2A
PF 169	230-240	325	80	6.3V/2A 6.3V/2A 5V/2A
PF 173	230-240	425	175	6.3VCT/3A 6.3V/2A 5V/2A
PF 174	230-240	285	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 175	230-240	385	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 545	240	Ext. 1000	2	6.3V/3A 6.3V/6A
		350	20	4V TAP 2.5/2A
PF 439	240	32V	60	240-32 STEPDOWN

POWER CHOKES FIRST PREFERENCE

CODE No.	HY IND.	D.C. RES.	D.C. MA
CF 102	15	300	60
CF 103	30	420	60
CF 105	15	250	80
CF 109	20	225	150
CF 196	20	130	125

POWER CHOKES SECOND PREFERENCE

CODE No.	HY IND.	D.C. RES.	DC MA
CF 106	12	200	100
CF 111	16	165	200
CF 112	10	70	250

If you have difficulty obtaining regular supplies, contact us immediately.

OUTPUT TRANSFORMERS FIRST PREFERENCE

CODE NO.	WATTS	PRIM Z	SEC. Z.		RESPONSE
OP 9	15	10,000, 6600 5000 PP	500, 250, 125		50-8000 C/S
OP 13	25	10,000, 6600. 5000 PP	500, 250. 125		50-8000 C/S
OP 24	5	5000 SE	8.4 OR 2.1		30-15,000 C/S
OP 25	15	10,000 PP	15-3.7 OR 8.4-2.1		20-30,000 C/S
OP 44	10	5000-2500 SE	500, 250. 125		50-8000 C/S
OP 54	10	5000-2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7. 2.3, 2.		50-8000 C/S
OP 58	15	10,000, 6600. 5000 PP	15, 12.5, 8.4, 6.5. 4, 3, 2.7, 2.3, 2.		50-8000 C/S
OP 63	15	10,000 PP	15, 3.75		30-15,000 C/S
OP 112	6	10,000 PP	2, 8	SUIT ROLA 12 OX	40-12,000 C/S
OP 113	6	5000 SE	2, 8		40-12,000 C/S
OP 118	6	8000 PP	2, 8		40-12,000 C/S

OUTPUT TRANSFORMERS SECOND PREFERENCE

CODE NO.	WATTS	PRIM Z	SEC. Z	RESPONSE
OP8M	15	10,000 PP	500, 250, 160, 125, 100, 83.5, 7.5, 62.5, 55, 50	50-8000 C/S
OP 17	32	10,000, 6600, 5000 PP	500, 250,125	50-8000 C/S
OP 19A	15	5000 PP	12.5, 8, 2.3	30-15,000 C/S
OP 65	15	10,000 PP	8.4, 2.1	30-15,000 C/S
OP 67	15	5000 PP	15, 6.5	20-30,000 C/S
OP117	6	5000 PP	8, 2	40-12,000 C/S
OP119	6	6600 PP	2, 8	40-12,000 C/S
OP 60	32	10,000. 6600. 5000 PP	15, 12.5, 8.4, 6.5, 4. 3, 7, 2.7, 2.3, 2.	50-8000 C/S

VIBRATOR TRANSFORMERS FIRST PREFERENCE

CODE NO.	PRIM VOLTS	D.C. VOLTS	O'PUT MA	BUFFER FULL SEC.
VT 104	6	250	60	.004
VT 210	12	250	60	.006

VIBRATOR TRANSFORMERS SECOND PREFERENCE

CODE NO.	PRIM VOLTS	D.C. VOLTS	O'PUT MA	BUFFER FULL SEC.
VT 116	24	250	60	.005
VT 208	6	250	60	.01
VT 209	12	250	60	.08
VT 211	32	250	60	.005 ea. half

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CHATSWOOD

FERGUSON

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JA 8491 (6 LINES

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about TV isn't a bad thing by
of a change.
e you in school, boys!
cannot let the month pass with-
some reference to more routine
ers.

ne other day I had occasion to
on a colleague of mine and found
puzzling over a mantel receiver
ell known make. I didn't notice
ther it was the four or five-
e version but the point really
n't matter.

hat's the trouble, mate?" I in-
ed.

scillates," he replied.

umph" or sounds to that effect.
r all, there's nothing very un-
l about a set oscillating. They've
doing that for as long as I can
ember.

t my friend went on:

've tried bypasses on the darned
g, prodding leads, shield can
ing seems to make any differ-
."

ried a new tube?" I enquired.

N'T BE SILLY!

e looked at me as if I were uncle
y. He was plainly reasoning that
be which is otherwise okay and
h is not sensitive to shielding can
be weaker than when it was
installed. Therefore, if it did
oscillate then, it shouldn't oscil-
now.

ou haven't read your "Service-
," I chided, although even he
n't know that I write these
mns.

nother don't-be-uncle-willy look!

f you read the said article," I
t on, "you'd have discovered that
iature RF amplifier tubes can
sionally suffer a build-up in grid-
e capacitance, due to deposition
he mica from the cathode emis-
. Higher grid-plate capacitance
lead to instability on weak signals
o signals."

fter such a build-up, I would
e looked an awful goat if it hadn't
e off.

must admit to some trepidation,
ever, when the IF amplifier valve
ed out to be a 6AU6, not the vari-
mu 6BA6. However, since the
valves are as like as peas in a
apart from the grid structure,
e is no reason why the 6AU6
ld not suffer in like manner.

nd that's the way it turned out.
a new 6AU6 in the IF ampli-
socket, the set was as docile as
could wish for.

JLTY TUBE?

ith a "well-I'll-be-darned" look
is face, my friend picked up the
ty tube, aimed at the WPB and
paused. Was it really faulty?

took the tube from him and walk-
nto his office-annexe. In a few
nents I had typed "High Cg-p"
a tiny slip of paper and sealed
gainst the glass envelope with a
p of adhesive tape.

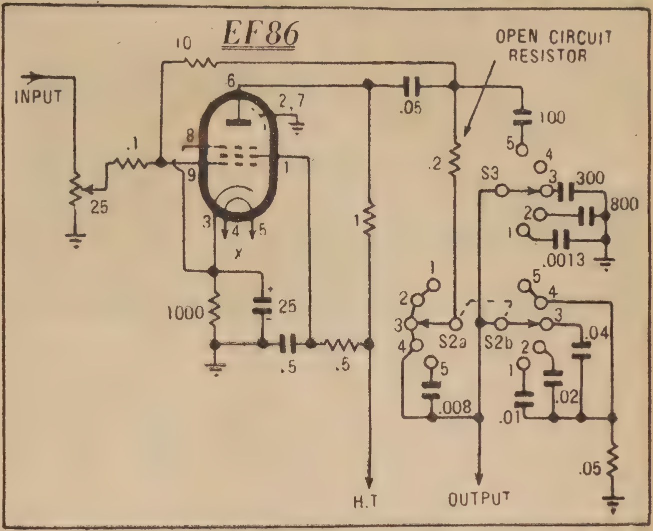
he tube's as good as a new one
audio work," I pointed out. "You
use it next time you have to
ice a charity amplifier for noth-
"

e pursed his lips, took the tube
put it in his "junk" box.

still don't know what the look
nt, but I laughed just the same.

he other incident is one which
interest R,T&H amplifier build-

TROUBLE IN R T & H CONTROL UNIT



A home-builder's efforts with a "Playmaster" control unit were defeated for a while by a faulty resistor—an expensive high-stability type!

A friend pulled up in his car and dumped a complete "Playmaster" amplifier on the counter, remarking that the thing was "as weak as water".

He'd put all the best parts into it, he explained; he'd wired it carefully and checked it a dozen times but it was still "crook". Would I please check it?

Knowing my friend's reputation as an engineer in another field, I didn't doubt his choice of quality components or his care with the construction. I wasn't so sure of his ability to wire and check the control switches. They're the easiest things in the world to get back-to-front.

EXCELLENT JOB

Inspection of his units revealed impeccable wiring, no obvious errors, no shaggy components and high stability resistors in all critical positions. But the thing certainly wasn't operating.

With a pickup feeding into the front end and using a Signal Tracer, it didn't take long to trace the signal through the first stage and through to the plate of the second amplifier. But there it stopped, with nary a whisper at the output network.

I expected to find a short to earth at this point, but everything appeared to be in order. Puzzled, I disconnected the low potential end of the 0.2 meg. resistor which coupled the second plate circuit to the output network.

There was a signal at one end of the resistor but not at the other.

Yes, you've got it! That little resistor, far from being a supreme example of the resistor makers' art, was completely open circuited.

Had my fussy friend built his unit with ordinary common or garden types, the chances are that he would never have run into the trouble.

I realise that there's no particular moral to the story, but it does emphasise the truth of the old saying, "You never can tell."

Another snippet which comes to mind, regarding this same engineer friend, might likewise be regarded as a story without a moral. On the other hand, it might possibly be of some assistance to those of you who drive a car—and who doesn't these days?

When he called to pick up his amplifier the following evening, my friend had a very worried look on his face.

"Generator's not charging," he said. "Leastwise, it only just keeps up with the drain with the parking lights on."

I comforted him by suggesting that he could have a burned-out generator, although it might only be trouble with the voltage regulator.

NO SIGN OF TROUBLE

Lifting the bonnet revealed no sign of smelling or heating in the generator, which at least looked hopeful. Since the voltage regulator was easily accessible, his next move was to remove the cover and have a look at the doings.

"Know how these things work?" he asked.

"Only vaguely," I replied, "but not enough to fiddle with the thing."

Nevertheless we did check to see that the wires were intact, the contacts clean and the actions were free. However, when he started the motor, the cut-out remained blithely open.

Only by pushing it closed with the motor revving would it stay that way and show any signs of charging.

My friend was in the car at the time, watching the ammeter.

(Continued on Page 125)

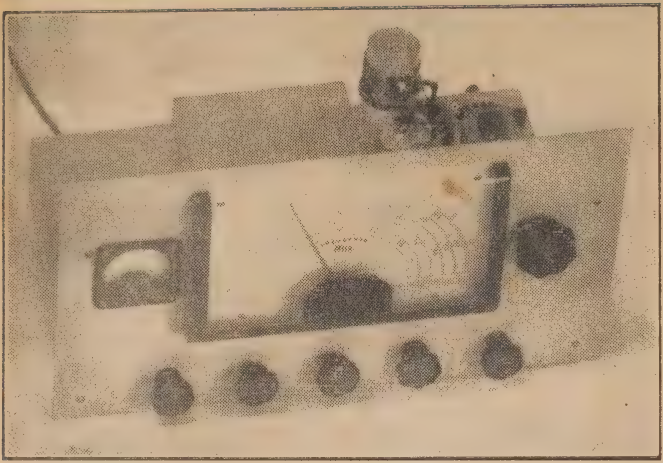


Figure 1. The panel of the new transmitter is 15 in. wide and 8½ in. high making it suitable either for our small size rack or a fully shielded table cabinet for TVI elimination if required.

ALL-BAND AMATEUR TRANSMITTE

It is a long time since we described a Ham transmitter, but here is one really worth waitin for. Capable of inputs up to 90 watts CW or 65 watts phone on all five high frequenc amateur bands, our new transmitter makes for the ultimate in operating convenience. single switch serves to select the band while a clearly and accurately calibrated dial ind cates your transmitting frequency almost within cycles. Plug-in tank coils have been elimin ated and there is only one tuning control.

by Maurice Findlay

THE predecessor of our new transmitter appeared in the April 1952 issue and since its description has done sterling service in the writer's own amateur station.

Briefly it consisted of a crystal oscillator followed by an 807 power amplifier. Switches were included in the crystal oscillator circuit to select the crystal frequency and the cathode coils for harmonic operation and in the plate circuit of the crystal oscillator to select the crystal frequency or the appropriate harmonic.

PLUG-IN SYSTEM

The 807 tank coils were of the plug-in variety, special plugs and socket being fabricated from disposals parts. Although subject to some discussion in the light of subsequent experience, we felt at the time that available switches were not capable of handling the voltages and circulating current, even with the input limited to 40 watts.

The power supply was built on the same chassis as the RF components and the transmitter rounded off with metering circuits, a key click filter and provision for the connection of an external VFO. Along with an aerial tuning unit, modulator, control unit and receiver, it was built into a table mounting rack.

This is largely by the way but what we are leading up to is that, although such a transmitter works well, it does leave something to be desired in operating convenience by 1956 standards.

We keep in touch with overseas periodicals, as no doubt do many of our readers, and the popular vote seems to favor compact transmitters which can be placed on the operating table and adjusted something after the manner of a receiver.

With the amateur bands crowded as they are, a good variable frequency oscillator is almost essential and this is usually built into the same cabinet. Transmitters capable of 1000 watts input have been built to this formula but, when appropriate power transformers plus a 500-watt class B modulator are involved, there is often a good argument for the traditional 19-inch rack-and-panel construction, plus a solid floor to support the weight.

Although by no means beyond most amateurs, the construction complete transmitter and VFO fairly lengthy project. Even calibration of the dial represe major effort, if accuracy and a appearance is required.

However, most of the prob which are difficult because o lack of factory process facilities been solved in the Geloso VFO numbers of which have been ported from Milan, Italy.

COMMERCIAL UNIT

Incidentally, the Geloso org ation manufacture a wide ran amateur and commercial equip of high standard. Although graphically close to Europe, American influence appears to been strong in their designs.

The VFO unit available he actually part of a complete am transmitter. Difficulties with i licensing make it impossibl import complete transmitter quantity but the VFO unit is able at low cost, considerin facilities it offers.

The oscillator is of the s tuned Colpitts type. The cou between the valve and the frequ determining components is very so that changes in valve chara istics have a second order effe frequency. The oscillator valve 6J5. It is followed by a 6AU6 i ing amplifier and then a 6V Output on all bands from 3 28 Mc is more than adequate to medium power beam tetrodes as the 807 and 6146.

MEASURES FOR STABILITY

The complete electrical circ reproduced here and is well studying to note the measure Geloso people have taken in to produce the desired result supplied the unit is completely tested and roughly aligned. The alignment, which should be u taken when the "Signal Shifte installed, can be made with th of an accurate frequency meter. an instrument is required to the possession of amateur s licensees by regulation in any

Supplied with the signal s proper is a large pre-calibrate with a moulded plastic escutche match. It would be very difficu the average amateur to produ dial comparing in either acc or attractiveness without very s facilities.

Many of our previous me power transmitters used the tetrode type 807 as a final power amplifier. This valve has a maximum plate dissipation of 25 watts under intermittent commercial or amateur service ratings. Typical efficiences are such that the valve can be used with about 60 watts input as a plate modulated class C amplifier and 75 watts as a keyed amplifier.

However, fairly recently a new type, the 6146, which largely supersedes the 807, has become available. The dissipation ratings are generally similar to those of the 807 and manufacturers publish typical operating conditions allowing up to 67.5 watts input on phone and 90 watts on CW.

APPLICATION DATA

It is interesting to compare manufacturers' figures relating to power input, efficiency, &c., for the two valves. Taking the 807 first, with 600 volts applied to the plate, the loading may be adjusted to 100 mA to give 60 watts input. The approx. power output is given as 42.5 watts giving an efficiency of 71 pc.

In the case of the 6146 with 600 volts supply, the loading may be adjusted to as high as 113 mA to give the 67.5 watts input. The power output is quoted as 52 watts by a well-known manufacturer giving an efficiency of 77 pc. Therefore, when using the new valve, you can expect a useful increase in efficiency quite apart from the greater power handling capabilities.

Looking at the comparative proposition in yet another way the 6146 offers a 20 pc increase in power actually delivered to your aerial.

Improvements in efficiency are not the only benefits from the new valve. The 807 uses the old style "pinch" construction, necessitating a long lead between the elements and the pins attached to the valve base. The 6146, on the other hand, used the newer "bantal" construction and the grid and cathode leads are reduced to a small fraction of the length of those in the 807.

NEW VALVE SHORTER

The overall length of the 807 is 5¾in, but the overall length of the 6146 is only 3¾in, the major part of the improvement being due to the elimination of the "pinch".

Low lead inductance, &c., allows the 6146 to be used at frequencies up to 175 Mc. The 807, on the other hand, can only be employed usefully up to about 75 Mc.

More important in the case of the present transmitter, which only operates up to 30 Mc., is the question of stability. With the 807 we have often had to adopt special measures such as neutralisation or the addition of chokes and suppressor resistors in order to obtain complete freedom from spurious oscillation. With the 6146 we found that it was merely necessary to bypass each of the cathode connections provided separately in order to obtain complete stability.

As a result, the new transmitter is one of the smoothest we have ever handled. Under no conditions of plate tuning with drive either present or absent is it possible to make the final amplifier oscillate in a spurious mode.

CIRCUIT OF ALL-BAND XMITTER

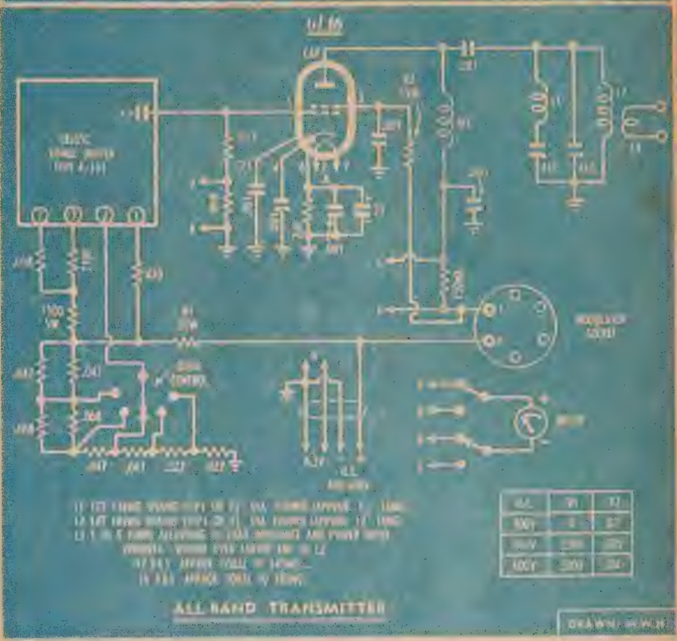


Figure 2. Circuit diagram of the new transmitter built around the Geloso 4/101 unit. It features an all-band tank circuit which dispenses with the need for plug-in coils. All resistors are 1 watt unless otherwise specified. The meter may have a basic sensitivity of 5 mA or better and shunts can be made experimentally by comparison with an accurate mA meter. Earth pin 8 of the 6146 socket.

At the time of writing the 6146 is temporarily in short supply but will be plentiful again within a week or so of this issue being published. We have plenty of ex-disposals 807's in stock but so impressed were we with the 6146 that we can see these finding their way into high powered amplifiers, voltage regulated power supplies and the like in future rather than Class C amplifier sockets.

We have discussed the VFO unit and the final amplifier valve so far but a third item of major interest in the new transmitter is the final amplifier tuning circuit.

This consists of two fixed coils and a broadcast type two-gang tuning capacitor. The five amateur bands between 3.5 Mc and 30 Mc are covered with one sweep of the capacitor.

We must admit that we were somewhat staggered by the idea at the first encounter but it has been used in a number of transmitters described in overseas amateur journals with every success. A list of references, by no means complete, is given here in case you would like to read further on the subject and it was largely from these that the present coil arrangement was developed.

An understanding of the behavior of the circuit can be gained from Fig. 3. It is drawn complete with all

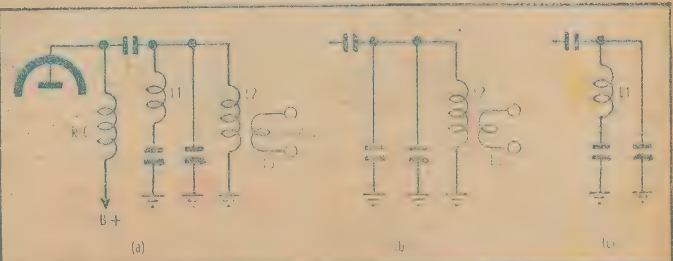
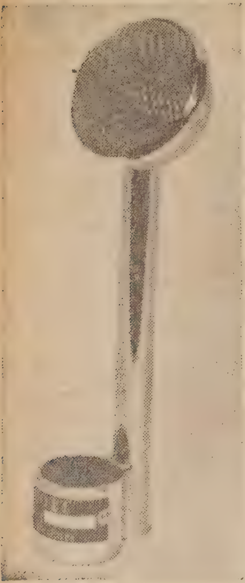


Figure 3. (a) The essentials of the shunt fed version of the multi-band tank circuit, (b) its behavior at low frequencies and (c) its behavior at high frequencies.



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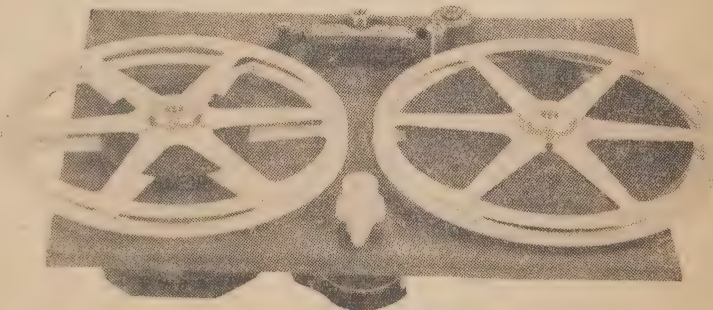

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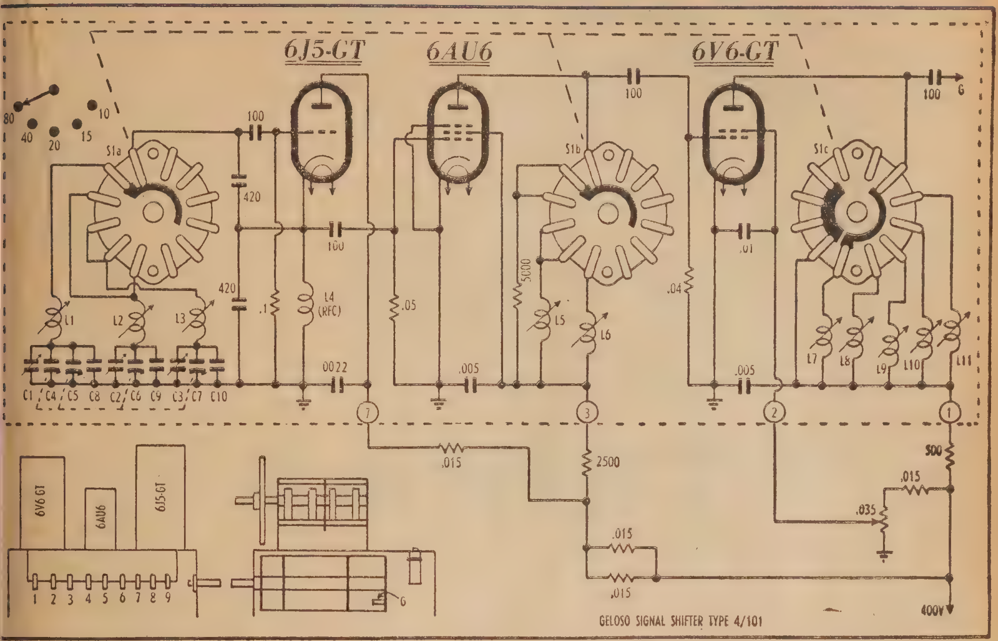

Figure 4. The circuit of the 4/101 unit with the original recommendations with regard to dropping network and screen control for the 6V6 amplifier. (These resistors are not supplied with the unit.) We have modified the arrangement to that shown on page 65 in order to use readily available components.

e essential elements at (a). The rallel feed arrangement using the ocking capacitor and radio fre- ency choke is not an essential part the new circuit but is used in this se to avoid stressing the tuning pacitor with the DC supply to the wer amplifier in addition to the F voltages.

L1 is a low inductance coil and a high inductance coil and in our rticular case there is negligible upling between them. At low fre- encies the inductance of L1 can neglected and the two sections of e tuning capacitor considered to be in parallel (b). The two sections of the tuning capacitor in conjunction with L2 then behave as a conventional parallel tuned circuit offering a high impedance at resonance. L3 is a link coil which may be coupled to a transmission line in the conventional manner the loading on the amplifier stage being adjusted by varying the number of turns on L3 and its proximity to L2.

At high frequencies, on the other hand, the impedance of L2 is high so that it behaves after the manner of the familiar RF choke. The circuit then behaves as at (c) and again a high impedance is presented between the plate of the valve and earth.

Although at high frequencies most of the circulating current flows through the circuit components shown at (c), L2 behaves as a transformer and the output is still coupled to the link coil.

We have separated L1 and L2 as low inductance and high inductance coil respectively but in actual fact, both coils play a part in the behavior of the circuit at all frequencies.

In order to tune over the amateur

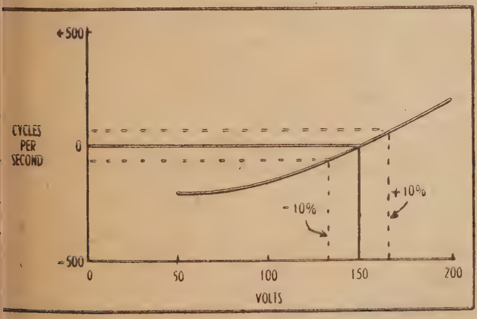

Figure 5. Variation in frequency with change in oscillator supply voltage measured at 3.5 Mc. Note that the change is only 70 cycles approx. for a 10 pc voltage change. Unless your mains supply voltge is abnormally unstable a voltage regulator tube is unnecessary.

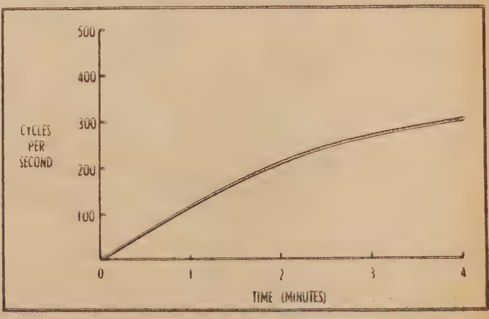

Figure 6. Variation in frequency with time after simultaneous application of heater and HT power. Zero time is counted from the commencement of oscillation. In practice, the heater would normally have plenty of time to stabilise before the HT is switched on.

AN OPEN LETTER

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TWO VIEWS OF THE TRANSMITTER

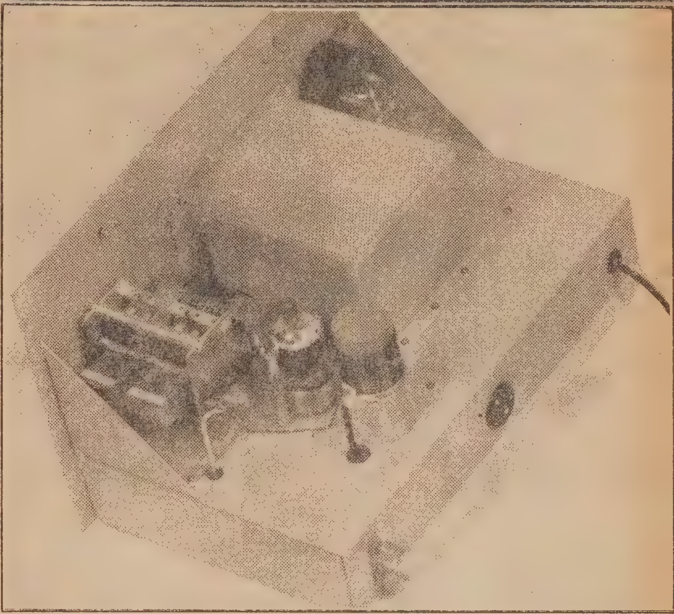


Figure 7. This rear view shows the 6146 and the components making up the all-band tank circuit. A shield around the VFO unit is essential to prevent spurious signals but it must provide adequate ventilatoin.

ands with the coil data given, a ood deal less than the 410 pF maxi- um capacitance of the tuning gang ; required. It would be quite in rder to remove some of the plates om both sections in order to make ne tuning less sharp but we did not onsider this necessary.

The gang, incidentally, is rated to ithstand up to about 750 volts peak cross each section and has behaved erfectly satisfactorily under all nditions we have tried.

As the circuit is always able to perate in two different modes it is ssential to make sure that when it operating on one of the lower equency modes, say 3.5 Mc or 7 Mc, ne frequency of the higher mode is ot an exact harmonic.

N IMPORTANT POINT

If, for example, 3.5 Mc and 14 Mc ccur at the same position of the ining capacitor the transmitter will evelop a strong fourth harmonic hen you are operating on 3.5 Mc. espite the fact that the aerial will robably not favor the fourth har- onic it is more than likely that an ppreciable amount of energy will be adiated.

We have chosen the coil induct- nces so that the tuning positions are s in Fig. 9, but if you decide to vary ne dimensions of the coils to suit omponents you wish to use, it is as ell to bear the above in mind.

In our experiments with this type f circuit, we have noticed that it is ossible to choose coil combinations hich give poor efficiency on one f the middle bands. Either 14 Mc or 1 Mc are most likely to be involved. his does not occur with the coils sed in the present transmitter but you find that the minimum plate urrent with the circuit unloaded n either of these bands is abnorm- lly high when using another com- ination of coils, some further ex- erimental work is indicated.

We have not been able to under- ake a worthwhile theoretical nalysis of the circuit and therefore re unable to offer a satisfactory xplanation of this point at present.

INGLE LINK

While conducting a series of ests for power output and effici- ncy with a fixed link coil feeding nto a resistive load we noted that ne loading was practically constant ver the entire range. It was sub- equently proved, by feeding into a eries of dipoles cut for the various ands that it is entirely practicable o use a single fixed link coil to feed nto a series of simple aerials where quick change from band to band is equired.

A typical variation in 6146 plate urrent would be between 60 mA nd 75 mA over the range. Most nodulators would be quite happy to ork into the slightly different load npedance and the difference in ower input would make little ifference to the signal strength.

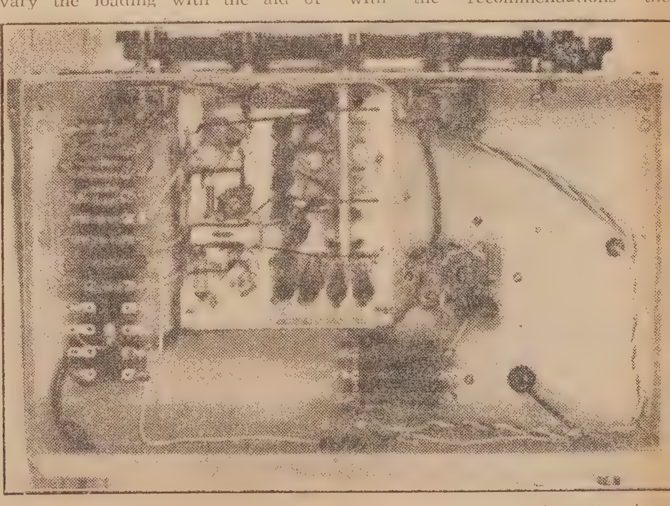
Many amateurs would like to have ull control over the loading and e intend to discuss this aspect of ne transmitter in more detail in an arly article.

A capacitor can be inserted in eries with the link coil and used o vary the loading. This is a simple nd effective system where it is de- ired to feed into an unbalanced ne, such as a co-axial cable, but here it is desired to feed into a balanced 75 ohm twin lead, it will either be necessary to balance out the capacitance between the frame of the variable capacitor and earth or use a two-section capacitor. The first is a difficult adjustment and the second assumes a large value capacitor.

In the case of an unbalanced system it would also be possible to vary the loading with the aid of a series of variable taps and this may have advantages in a compact design.

This completes a general discussion of the features of the transmitter. It now remains to discuss the construction and adjustment of the new transmitter in detail.

The circuit of the Geloso Signal Shifter is reproduced here together with the recommendations the



Fgiure 8. Underneath view. With the exception of those around the 6146 socket, the wiring components are mounted on panels. Controls, from left to right, are drive, tuning, band change and meter switch. The knob at the extreme right is unused at the moment but allows for a loading control if required.

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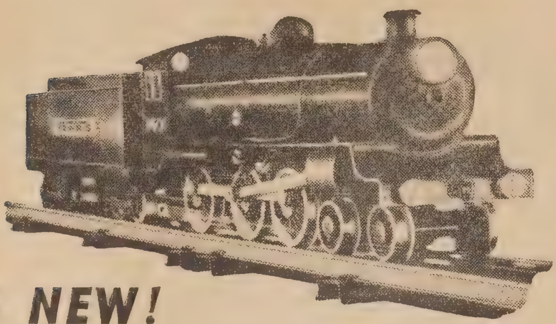

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manufacturers make with regard t the power supply, voltage and dropping network for the low powe stages. At the recommended 400V the current drain is likely to var between about 35 mA and 55 mA depending on the setting of th screen potentiometer of the 6V6.

Low C and hence low-Q broadband circuits have been employe in the Signal Shifter as well a resistive coupling on the two lowe frequency bands, with the object o keeping the output as nearly constant as possible over the entir range.

DRIVE CONTROL

However, there is inevitably som variation and this, together wit the coupling between the plate an grid circuits of the 6146, due to th common electron stream, makes i essential to have some means o controlling the drive to the fina amplifier.

Although the original Geloso circuit does provide this facility i assumes a potentiometer with a hig power rating. We have overcom the problem by substituting a divide network using fixed resistors and five-position switch. This is abou the minimum number of position capable of taking care of all possibilities but does allow a wide choic of switch types.

REFERENCES

The following articles mention the multi-band circuit and illustrate its uses.

King. "No Turrets — Just Tune!" QST March 1948 P. 59.

Chambers. "Three - Control Six-Band 813 Transmitter" QST January 1954 P. 11.

Chambers. "Supplementary Data on the Three-Control 813 Transmitter" QST June 1954 P. 37.

Johnson. "Multiband Tuning Circuits" QST July 1954 P. 25.

Johnson. "The Briefcase Transmitter - Receiver" CQ November 1954 P. 34.

Egbert. "A Modern Medium-Power Transmitter" QST October 1955 P. 11. (Multiband driver tuning.)

You will note also from a stu of the circuit of our transmitte that one of the resistors in the dropping network must have a hig power dissipation rating. If the 750 ohm unit is not available it woul be in order to substitute 10,00 ohms.

STABILITY

The absence of a voltage regulato tube in the oscillator supply ma raise a query in the minds of som readers. You can install a 150-vol glow-discharge tube, such as th OD3/VR150 or the 150B2 if you wis with minor modifications to th dropping network, but, frankly, w feel that you would be wasting you money.

We set the oscillator zero bea with an accurate frequency mete with the supply voltage at 150. Th supply was then varied between 5 volts and 200 volts and the chang in frequency noted by comparin the beat note with the output o ı audio generator. Even over this treme range the change in fre- ıency was small and as indicated the broken lines on the curve igure 5), the change in frequency only likely to be of the order of cps with a 10 pc change in supply lts. Note that this corresponds a change in mains voltage from e nominal 240 to 215 volts or 265 lts.

The measurements were carried it with the oscillator operating in 5 Mc but a quick check indicated at the performance of the oscil- tor when operating on a 7.0 Mc ndamental is in direct proportion frequency.

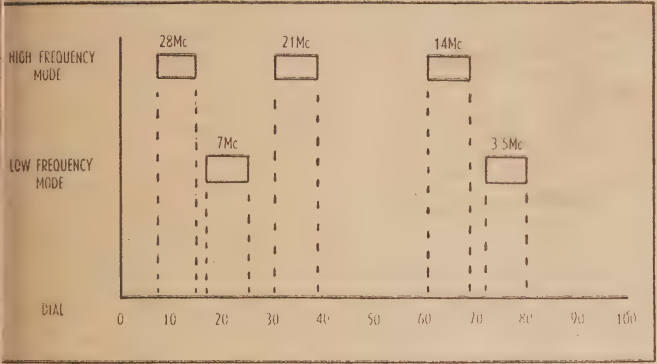

Figure 9. A typical relation between dial setting and frequency for the multi-band tank circuit. Make certain that 3.5 Mc and 14 Mc and also 7 Mc and 28 Mc do not correspond with the same dial setting in order to avoid accentuating harmonics.

Variations in frequency during arm-up are also very small. In e normal way the filaments would switched on well before the high nsion so that the cathode would able to reach its operating tem- rature. By way of a severe test e applied both high tension and ament power at the same time ıd noted the variation in fre- ıency from the time oscillation ımmenced to the time the frequency abilised. At the fundamental 3.5 c the total variation was approx. 0 cps.

These tests concern characteristics hich are primarily electrical. The set stability of the switch and ning gang are not of this order ıd you cannot expect to change and or change frequency and return your original frequency with rors as small as this from dial adings alone.

As with any VFO unit of this pe there is some change in fre- ency with mechanical shock and e do not recommend mounting the FO in a position where it is likely be bumped or subject to vibra- on such as in a motor vehicle. ot if you are interested in the der of stability most amateurs mand these days, at any rate!

You will note from the rear photo- aph that we have placed a shield er the top of the VFO unit. The bject is to prevent coupling be- een the final tank and frequency termining circuits which could sily lead to spurious signals.

In our case it appeared to be suf- cient to bolt the shield to the chassis but, if you have any difficulty on this score, the bonding should be extended to the front panel.

Coupling between the plate of the 6V6 in the VFO and the grid of the 6146 is by means of a 100 pf capacitor, this component being included in the purchased unit. The circuit has a fairly high impedance and there is everything to be said for keeping the leads short.

Most of the bias for the class C amplifier is obtained from the rectified current flowing in 6146 circuit. The grid and cathode of the tetrode behave as the plate and cathode of a diode and the result is that the potential at the grid has an average value which is negative with respect to ground. The average value is maintained by the charge on the coupling capacitor and, at the frequencies we are considering, does not change appreciably for a large number of cycles.

The value of the steady bias obtained from the grid circuit can be calculated simply by multiplying the grid current (expressed in amperes) by the value of the grid resistor in ohms, a useful point to remember when you are checking with manufacturer's published data

However, we must consider the possibility of the drive failing or the tank circuit of the amplifier being completely detuned and provide some protection for the valve. The easiest way of doing this is to include a series cathode resistor which provides a measure of protection should something go wrong.

The value of this resistor is a compromise and when you are anxious to obtain the maximum power output from the valve there may be an argument for using a smaller value than the 200 ohms we have shown on the circuit.

In this case it would be desirable to include some protective device for tuning up. Either the cathode resistor could be switched between protective and operating values or the high tension supply could have a "tune" and an "operate" position.

With the value of grid resistor shown, we recommend that the grid current be adjusted to between 2.5

(Continued on page 111)

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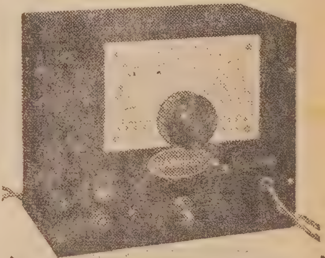

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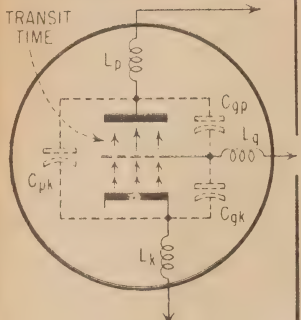
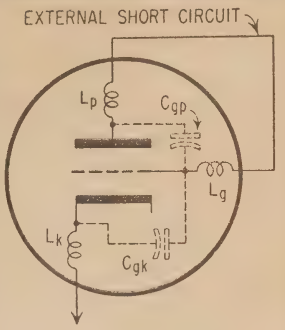


TUBE FACTORS WHICH BECOME ESPECIALLY IMPORTANT AT HIGH FREQUENCIES

FIG. 1



LIMIT OF HIGHEST FREQUENCY BY LEAD INDUCTANCE AND INTER-ELECTRODE CAPACITANCE

FIG. 3

The last decade has seen a vast development of the frequencies above 30 Mc, particularly the VHF (30-300 Mc) and UHF (300-3000 Mc) ranges. The most important influences in this development have been radar, aircraft communications, and FM and TV broadcast services. In all these, oscillators play a vital role. This article discusses the features of oscillators designed for operation in these ranges and using vacuum tubes of conventional design.

VACUUM tubes of conventional (although sometimes somewhat modified) design, are now being used in commercially-available equipment as oscillators operating as high as 1000 Mc and above.

However, successful operation in the VHF and UHF regions of the spectrum require that certain difficulties be overcome. These difficulties arise from vacuum tube factors, and circuit factors, which, although not noticeable at low frequencies, take on special significance in the higher frequency ranges.

LIGHTING FACTORS

Figure 1 illustrates these factors, which are, as far as the tube itself is concerned, transit time, lead inductance, and interelectrode capacitance. These electrical tube factors are discussed first, followed by additional important circuit and physical factors.

Transit time is the time it takes an electron in the tube's electron stream to travel from cathode to plate. If this transit time is appreciable compared to the period of 1 cycle at the desired frequency of oscillation, it is extremely difficult to sustain oscillation.

This is because, as the transit time approaches the period of 1 cycle, the phasing between plate and grid voltages is affected in such a way as to introduce the effect of **shunting resistance** (conductance) between grid and cathode.

Since all or part of the tuned circuit is connected or coupled between grid and cathode, the oscillating circuit is adversely loaded by this resistance effect. An undue amount of power may thus be dissipated, and in severe cases (higher frequencies and unsuitable tubes) sufficient energy cannot be fed back to sustain oscillation.

Many tubes which have input impedances as high as 5 to 20 megohms at low frequencies, (below 3 Mc) have values as low as 20 to 200 ohms at 500 Mc and higher.

Transit time is obviously a function of the spacing between the cathode and the plate of the tube; tube; the greater the spacing, the longer it takes for the electrons to traverse the span. It is also a fun tion of the relative grid-to-catho spacing, since the effect on the rel tion between the grid and the pla it important.

The Gm (transconductance) of t tube, which, of course, is influenc by these spacings, also affects tra sit-time. The conductance, whi is the harmful effect, resulting fro transit time, is directly proportior to Gm and inversely proportional the square of the frequency.

HIGH Gm NEEDED

However, the Gm must be ke high to support oscillation and pr vide stability, to the minimisi spacings and interelectrode capac tance.

An increase in plate voltage r duces transit time by speeding the electron stream, but increasi plate voltage over its rated value likely to overload the tube, and so not a satisfactory method.

The magnitude of the effect transit time on input loading can gauged from the following expre sion.

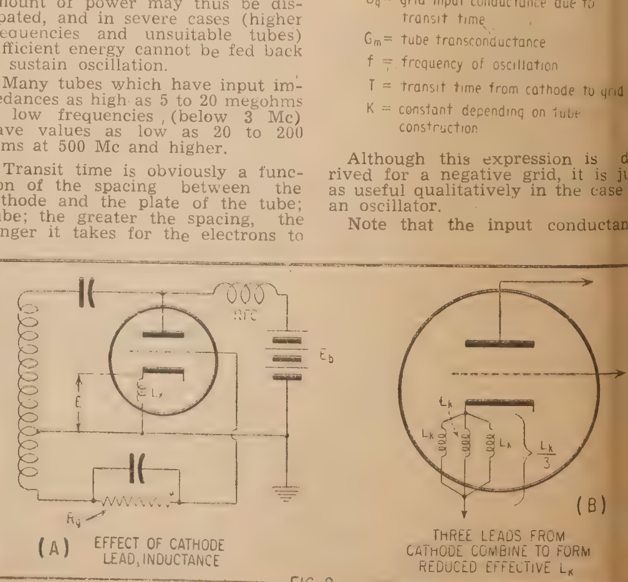
$$G_g = KG_m f^2 T^2$$

where

G_g = grid input conductance due to transit time
G_m = tube transconductance
f = frequency of oscillation
T = transit time from cathode to grid
K = constant depending on tube construction

Although this expression is d rived for a negative grid, it is ju as useful qualitatively in the case an oscillator.

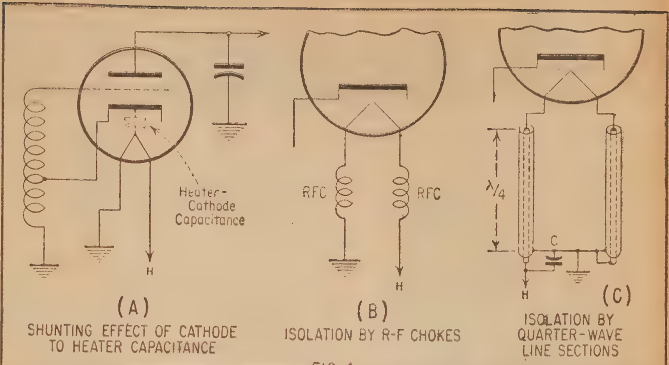
Note that the input conductan



(A) EFFECT OF CATHODE LEAD, INDUCTANCE

(B) THREE LEADS FROM CATHODE COMBINE TO FORM REDUCED EFFECTIVE L_k

FIG. 2



(A) SHUNTING EFFECT OF CATHODE TO HEATER CAPACITANCE

(B) ISOLATION BY R-F CHOKES

(C) ISOLATION BY QUARTER-WAVE LINE SECTIONS

FIG. 4

eases (resistance decreases), n the **square** of the frequency. s the input resistance of a tube 00 mc can be expected to be only ten-thousandth of its value at c.

ead inductance is the self-intance of the wire connecting each e element to its corresponding cap or connector. At high frencies it represents an appreciable **tance** between the tube elements the external oscillator circuit.

n the conventional grounded ode oscillator circuits, cathode inductance is of particular imance. The reason for this is ilrated in Fig. 2 (A). The cath- lead inductance Lk is in series n both the plate and the grid r-f rn circuits.

GATIVE FEEDBACK

therefore develops a feedback age E which is degenerative, the e as in the case of an unbypassed ode resistor in an audio ampli- At high enough frequencies, degenerative effect seriously inres with oscillation.

e presence of cathode lead inance (Lk) causes the effective age between grid and cathode e tube to have a different phase e than that of the externallyied voltage. The difference is to the feedback voltage across due to plate current.

e result is a conductance coment in input admittance which to the conductance due to the sit time.

has been shown that input conance due to Lk is—

$$G_g = \omega^2 G_m L_k C_{gk}$$

e

g = input conductance due to L_k

ω = angular velocity of oscillation ($2\pi f$)

m = tube transconductance

k = cathode lead inductance

gk = grid-cathode interelectrode capacitance

d effects also result from innces of other leads, as is disd later in this article.

reduce the effect of lead induc-, many tubes designed for high ency use are supplied with two ore leads and external connecfrom the same element. The or more leads can then be coned together right at the socket. is connects the lead inductances arallel, thus reducing the total inductance effect to the inducof one lead divided by the numf leads so connected.

is is illustrated for a cathode in Fig. 2 (B).

NTING EFFECT

erelectrode capacitances have a ting effect due to their relativew reactance value at high frecies. The charging current gh these capacitances results in r loss in the resistance of the it and adds to the power loss in ielectric, which is the insulating rial of the tube.

e oscillation frequency is deterd not by the external tuned circonstants alone, but by the ex- tuned circuit plus the lead innce and interelectrode capacis of the tube. The combined effective tuned circuit thus reaches an irreducible minimum size (and maximum resonant frequency) when the external tank is replaced by a direct short circuit.

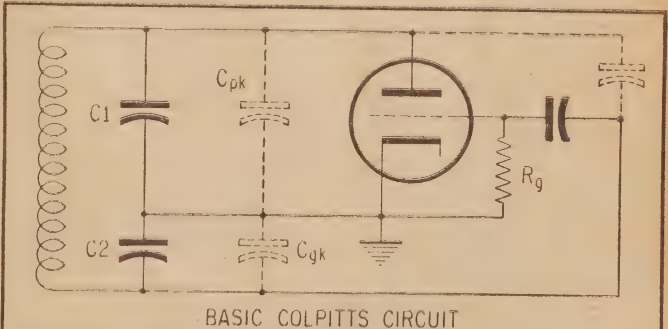
The effective tuned circuit is then composed of the lead inductances and the inetrelectrode capacitance, as illustrated in Fig. 3. Since nothing further can be done to decrease inductance or capacitance, the tube has reached its upper frequency limit, even though transit time might allow it to operate at a higher frequency.

Thus, if a tube is to oscillate at a very high frequency, its lead inductance and interelectrode capacitance must be small enough to allow resonance with some sort of external tuned circuit. Preferably the plate, grid and cathode must be located so that a high frequency tuned circuit can be directly connected without intervening leads.

Triodes are by far the most popular type of tube for high frequency oscillators, because of their low interelectrode capacitance. Types with the highest Gm are, of course, the most suitable. As has been previously explained, having several leads from each of the active elements is also helpful.

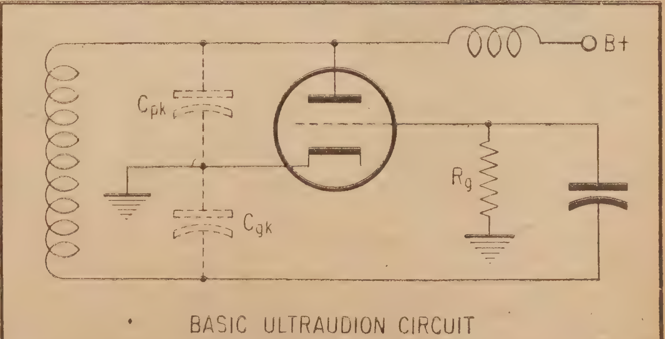
Even when the vacuum tube is properly chosen, high frequency operation may be adversely affected by the character and construction of the circuit.

All kinds of circuit losses increase rapidly with frequency, and, if not properly controlled, may keep feedback from being sufficient to support



BASIC COLPITTS CIRCUIT

FIG. 5



BASIC ULTRAUDION CIRCUIT

FIG. 6

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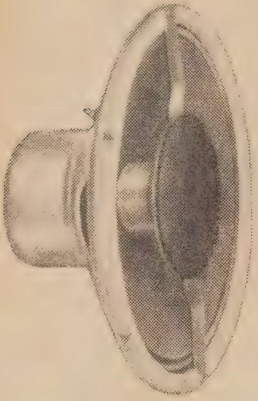

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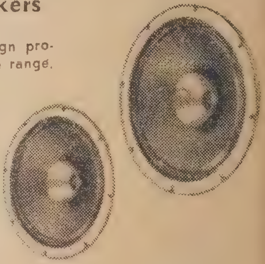

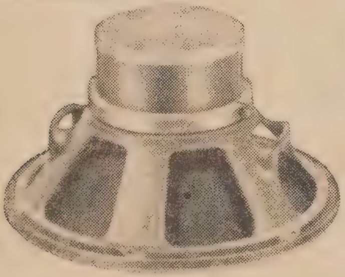

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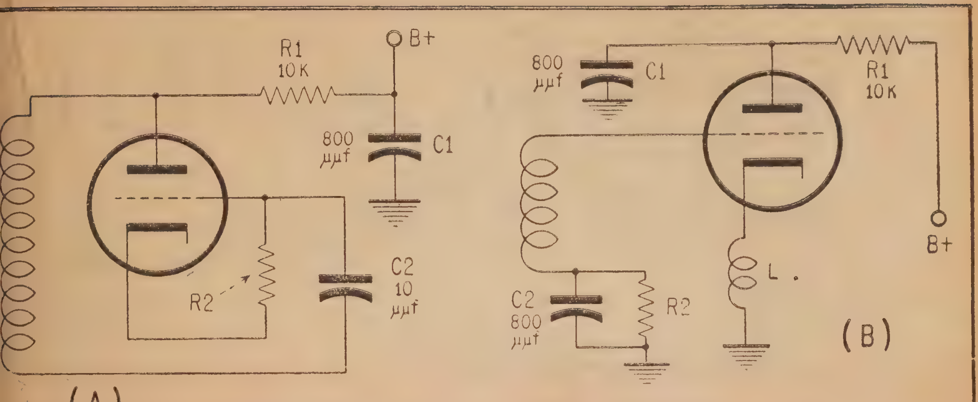


ULTRAUDION CIRCUITS USED IN TV RECEIVERS

FIG. 7

ation. Wiring must be direct of heavy-gauge wire to combat effect, wherever r-f current .

y points of r-f voltage should ther suspended in air or mount- n low-loss material such as tyrene or polyethylene. Al- gh chassis grounding should be rect as possible, it should all be at one point in each circuit, to ent bad effects of r-f currents in hassis.

dered connections must be the possible; any tendency toward a joint" or "rosin joint" can in- ce extreme losses and may pre- oscillation.

e construction of modern um tubes is such that there is ppreciable capacitance between heater and the cathode (2 to 10 Thus, in circuits in which the ode is operated above ground, us shunting of the cathode can through this capacitance to the nded heater, as shown in Fig. 4.

is can be overcome by isolating eater from ground as far as r-f ncerned, and operating it in the at the same r-f potential as the de. One way of doing this is n at (B) in fig. 4.

r-f choke is connected in each er lead; the cathode r-f volt- can build up across the react- of each choke, although the os alternating current for the er is allowed to pass.

RTER-WAVE LINE

other arrangement is shown in 4 (C). Here the heater is ed from r-f ground by means quarter-wave resonant transmis- line section in each lead. Both sections are short-circuited to t the bottom (one directly, the through capacitor C).

is means that there is a high lance at the other end between nner conductor and the ground- outer conductor. The heater are fed through these inner uctors and are thus at a high dance to ground, thus prevent- hunting of the cathode.

ny of the same types of cir- t used at low frequencies are popular in the VHF and UHF es. Such circuits as the Hart- re frequently encountered, es- lly in the "grounded plate" n

High frequency versions may be a little difficult to recognise at first as special tank circuits and other construction are often employed.

Of particular importance is the Colpitts circuit, of Fig. 5, not only because it is sometimes used itself, but mainly because it is the basis of the very popular ultraudion circuit, which will be explained presently.

The Colpitts oscillator circuit is the same as the Hartley except that the cathode is tapped into the resonant circuit by means of a capacitance voltage divided C1-C2, instead of a tap on the coil.

One advantage of this arrangement is that the two inter-electrode capacitances Cpk and Cgk are not connected directly across parts of the coil, as they are in the Hartley. They are shunted by tuned circuit capacitors C1 and C2.

VARIATION REDUCED

The latter have large values, since they combine in series to provide the total external resonant circuit capacitance. The effect of inter-electrode capacitance variation on the frequency of oscillation is thus minimised.

There is one disadvantage in the Colpitts circuit when the oscillator is to be tuned over a range, as in receiver local oscillators. Either C1 and C2 must be tuned together, or another capacitor must be added across all or part of the coil to provide tuning adjustment.

The relative values of C1 and C2 determine the amount of feedback, just as adjustment of the tap did in the Hartley oscillator. Thus, variation of either of these capacitors alone would vary feedback, as well as frequency, an obviously unsatisfactory condition.

The ultraudion circuit is undoubtedly the most popular of any of the circuits used for the VHF and UHF ranges. It is widely used as the local oscillator in communications, FM broadcast and TV broadcast receivers, because of its simplicity.

VOLTAGE DIVIDER

The circuit is actually simply a Colpitts type in which the plate-cathode and grid-cathode interelectrode capacitances form the voltage divider across the coil.

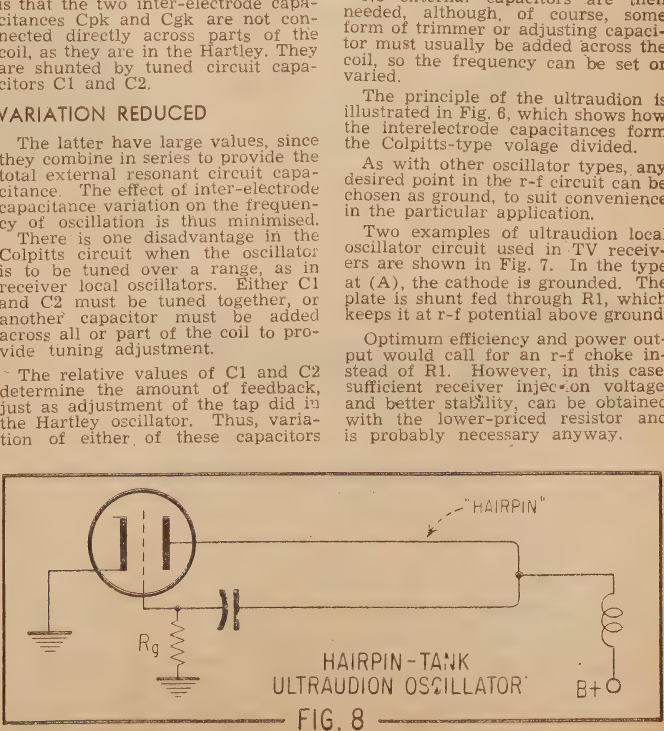
No external capacitors are then needed, although, of course, some form of trimmer or adjusting capacitor must usually be added across the coil, so the frequency can be set or varied.

The principle of the ultraudion is illustrated in Fig. 6, which shows how the interelectrode capacitances form the Colpitts-type volage divided.

As with other oscillator types, any desired point in the r-f circuit can be chosen as ground, to suit convenience in the particular application.

Two examples of ultraudion local oscillator circuit used in TV receivers are shown in Fig. 7. In the type at (A), the cathode is grounded. The plate is shunt fed through R1, which keeps it at r-f potential above ground.

Optimum efficiency and power output would call for an r-f choke instead of R1. However, in this case, sufficient receiver injection voltage, and better stability, can be obtained with the lower-priced resistor and is probably necessary anyway.



HAIRPIN-TANK ULTRAUDION OSCILLATOR

FIG. 8

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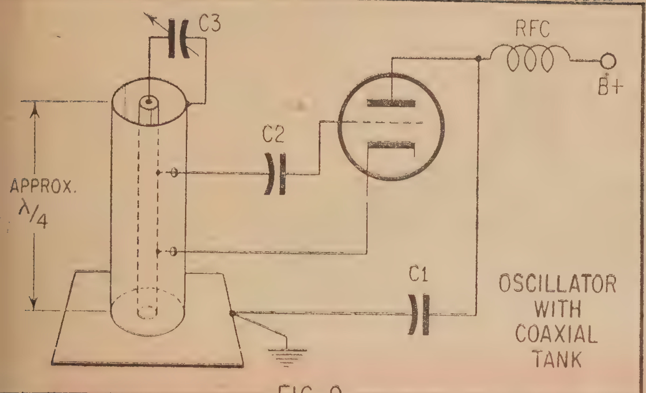


OSCILLATOR WITH COAXIAL TANK

FIG. 9

n the circuit at (B), the plate is ounded to r-f, through C1. This ans that both the grid and the hode must operate at above-ground potential. The cathode is kept ove ground by means of the cath- e choke L, which allows d-c cath- e current to pass through from ound to the tube.

Because of the relatively high cir- t losses and the effects of transit ne at high frequencis, the inherent biliy of an oscillator lessens as the quency is increased into the VHF d UHF regions.

One way to compensate for this is design the resonant (tank) circuit it has a very high Q, and thus ds to stabilise the oscillator as a ole.

This can be done by using a reson- section of a transmission line as e tank circuit, instead of the ordin- coil and capacitor.

For example, a quarter-wavelength tion of transmission line, short- cuited at one end, exhibits at the er end the characteristics of a y high Q parallel-resonant circuit.

NE SECTION TANK

By slight adjustment of the length the line section, it can be made combine with circuit and tube re- ance plus added tuning capacitance desired, to resonate at the required erating frequency. An open-ended section a half-wavelength long n be used in the same way.

An example of the use of a line tion for the tank circuit of an os- ator is shown in Fig. 8. Because the appearance of the shorted line which is usually fashioned from a single piece bent into shape, this arrangement is often referred to as the "hairpin" oscillator.

Actually the circuit is an ultraudion, and the construction is about the simplest of any practical oscillator.

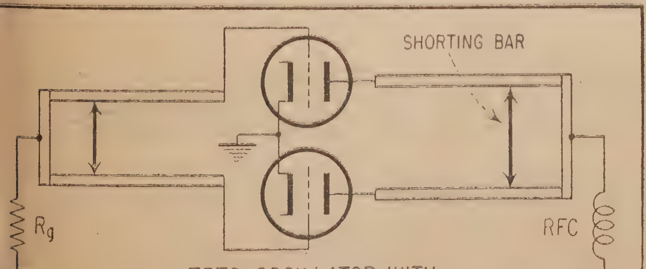
This application is not limited to open wire lines, but coaxial line sections also can be used. A Hartley circuit using a quarter-wave coaxial section is shown in Fig. 9. The line is shorted and grounded at the bottom, where the plate is also connected through C1.

GROUNDED-PLATE HARTLEY

The circuit is thus a grounded-plate Hartley. The leads from the cathode and grid respectively are fed through the outer conductor of the line section and tapped on to the inner conductor.

This stimulates the connection of these leads to the tap and top respectively of a conventional coil. C3 is added for variation or adjustment of frequency. Sometimes frequency adjustment is provided by a shorting plug of metal between the inner and outer conductors, which is moved to change the electrical position of the bottom short circuit.

Push-pull oscillator circuits have the advantage at high frequencies that the combined effective interelectrode capacitances are lower than those of each tube alone. A typical push-pull tuned-plate-grid oscillator circuit using transmission line tanks is shown in Fig. 10.



TPTG OSCILLATOR WITH TRANSMISSION-LINE TANK CIRCUITS

FIG. 10

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APPLICATIONS

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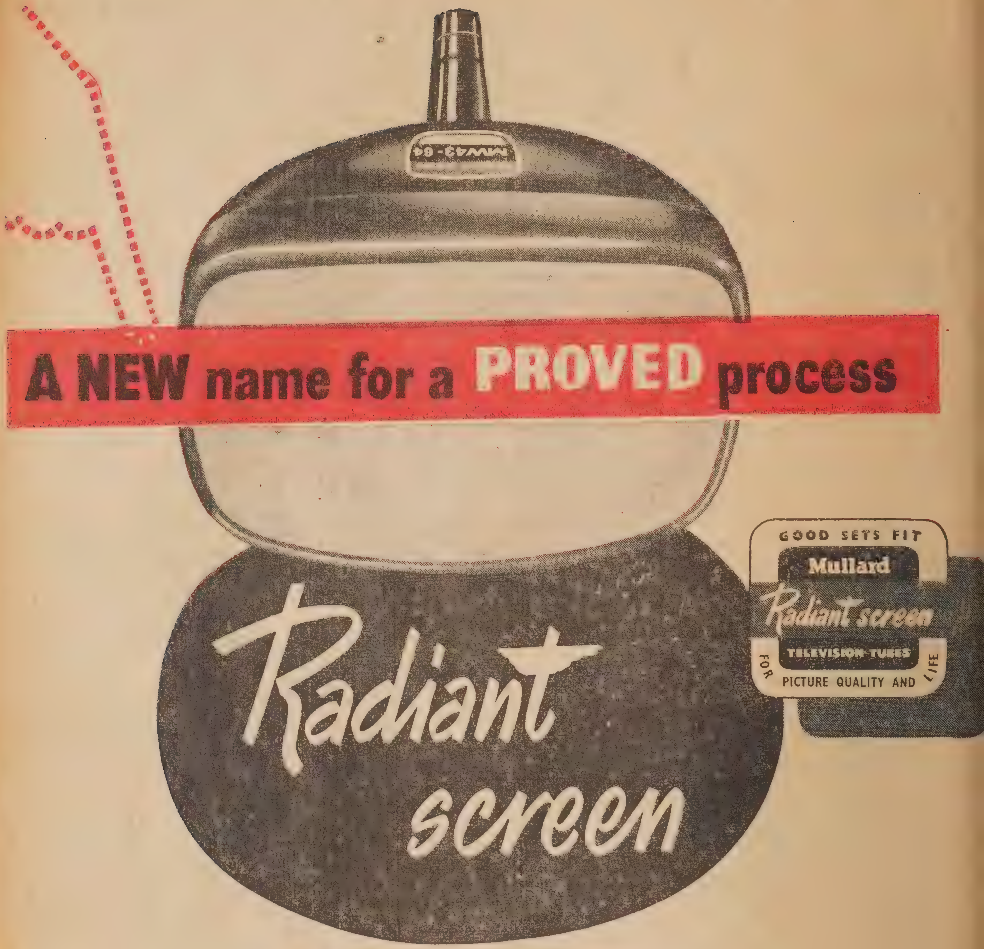
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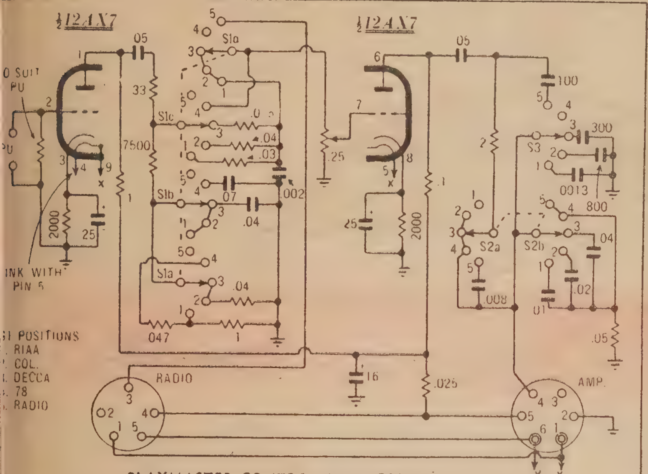

PLAYMASTER CONTROL UNIT FOUR (MODIFIED)

espite a double check on the circuit of Control Unit Four, modified last month, t was printed with a very necessary junction missing between S2 and S3. Without his junction, the treble cut would not function. The correct circuit appears above. he correction could be noted in your March issue, to avoid possible confusion at some future date.

PROBE TYPE SIGNAL INJECTOR

(Continued from page 39)

aid of a multimeter but, in an ergency, momentary shorting of HT line to earth would give quate indication. In many cases will reveal a weak or dead tifier and replacement will ef- immediate cure.

hese are routine checks and uld be carried out, no matter at the ultimate method of fault ection is. If they do not reveal nature of the fault, the signal ector can then be brought into ration.

or reliable results the frame of injector should be bonded to chassis of the set under test. s is automatically effected, if the s own power supply is used. If the chassis of the injector power ply should be connected to the by means of a jumper lead.

hen, with the receiver volume ned up and the injector output maximum, the probe is touched the grid of the output valve. ess the stage is weak or inopera- this should bring forth a burst ignal from the loudspeaker.

he output of the probe is then isted to a convenient level, and n of the preceding grids touched urn. Depending on the gain of individual stages, this should ilt in a progressively higher out- until the faulty stage is reached. re there is no increase in signal l, or where the signal completely ppears

nce the fault has been localised his fashion, the stage is examined in the usual way and the necessary steps taken to rectify it.

The main advantage of this method is the speed with which the faulty stage or stages can be localised. Apart from keeping the probe output at a reasonable level, no adjustments to the probe or the set are required, because the signal injector provides a continuous band of frequencies covering everything from audio to short wave.

Against this, the receiver and a signal tracer must be kept tuned to the same frequency, if the test is to give conclusive results, as also the signal generator, if the latter is used.

This, and the fact that the tracer probes have to be changed when going from RF to audio, can result in an appreciable increase in time spent on servicing receivers. Besides, as mentioned earlier, a large proportion of receivers can be tested and repaired on the spot, yielding a further increase in time saved, which means a reduced charge to the customer.

In these days where time is scarce and expensive, the saving of time will be most welcome to the serviceman, and nobody will deny that the customer will appreciate the lower service charge.

As a final thought it would be wise to mention that before placing the signal injector into regular service, the instrument should be tried out on several known good receivers in order to establish what output levels can be expected for different input points.

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A COURSE IN TELEVISION

PART EIGHT . . . . TELEVISION RECEIVING AERIAL

Following the general discussion, last month, of VHF propagation and aerial systems, the reader should now be in a favorable position to grasp the special problems which surround the design and installation of television receiving aerials. Our article, this month, deals exclusively with this most important subject.

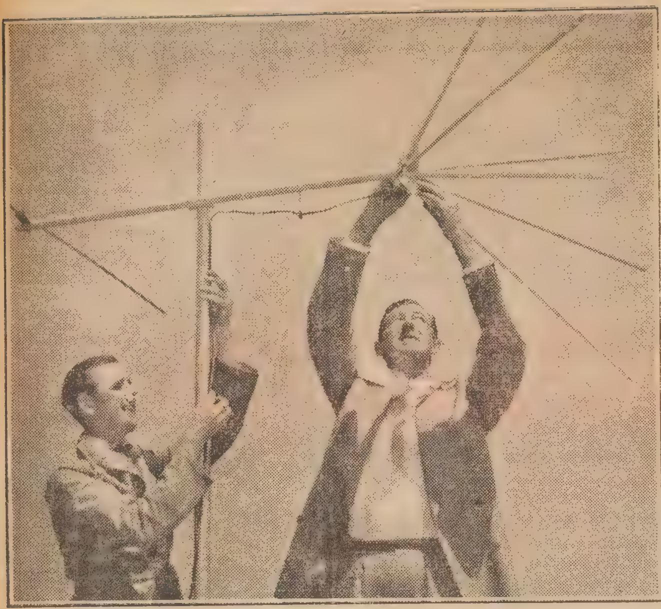


Figure 55: Australian actor-producer Chips Rafferty adjusts an all-band fan-type television aerial on the roof of his Kings Crosss (Sydney) flat. This particular aerial is being marketed in Australia by Hills Hoists Pty. Ltd.

FOR those who may not have studied last month's article in detail, it may be helpful to restate a number of facts, based on a general knowledge of VHF practice but applicable to television broadcasting.

These may be listed as follows:—

(1) Television receiving aerials are invariably designed to exhibit resonant characteristics over the range of frequencies at which they are intended to operate. Resonant aerials give greater signal pickup than a much longer but random length of wire.

(2) Most television aerials are derived from the basic half-wave dipole.

(3) Television aerials are normally constructed from metal tubing, from rods or heavy-gauge wire cut to specific length and bent to specific shape according to the electrical design.

(4) The aerial element(s) must be mounted in a suitable plane to receive the horizontally polarised signals, which will be radiated by the major Australian transmitters. This normally means that the aerial element(s) must be mounted parallel to the earth's surface.

(5) Horizontally mounted aerials have marked directional properties, and normal procedure is to face the element(s) broadside on to the transmitting site, to ensure maximum signal pickup.

EXTRA ELEMENTS

(6) Aerials having additional elements to achieve a beaming effect are useful in average to weak signal areas or in locations where it is desirable to favor the signal and discriminate against interference.

(7) Signals are transferred from the aerial to the receiver by means of a transmission line, which must match the characteristics of both aerial and receiver input.

(8) A television receiving aerial presents a unique problem in that should ideally be responsive over very wide range of frequenci typically from about 50 to 200 Mc.

This last requirement is especial noteworthy because it conflicts wi several of the preceding par graphs:—

(a) In the natural way, dipo aerials give adequate response or to a relatively narrow band of fr quencies, even allowing for the u of large diameter elements. (Beam arrays are naturally ev more "selective" in their operati than simple dipoles. (c) Matching a transmission line to the aerial a receiver is made difficult when wide range of frequencies is i volved.

COMPROMISE

Because of the above difficulti the design of a general purpose te vision aerial system does not yield the formulas and graphs norma applied to the VHF aerials.

The designer must be prepared to manipulate the shape and dimensions of the aerial system until, by one means or another, it shows an adequate response and an adequate beaming effect over the required range of frequencies.

Over the years, many televisi receiving arrays have been c veloped, showing different orders electrical performance and differe degrees of mechanical complexity.

Some have exhibited low wi resistance, others have seemed mu too likely to blow down in a ga some have looked "smart", oth have been nothing less than "e sores"; some have been ignor others backed by big sales ca paigns.

To illustrate and discuss all possible designs would occupy more space than is available h and the reader who wants to kn all about TV aerials, perhaps w a view to manufacturing them, m be prepared to search elsewhere the information.

A good deal of this informat may be difficult to locate, if o because many of the aerial syst are as much the product of cut-a dry methods as of any rigor mathematical approach.

Just how ambitious and comp a television aerial needs to be, pend largely on the receiving si whether it happens to be in an ere the signals are very strong, y weak, or just average.

he use of an aerial which is need- y elaborate may be unecono- al. Conversely, the use of a too- mitive or a badly-placed aerial y seriously prejudice the ultimate ture quality.

To simplify aerial problems at e receiving end, it is usual to oup television stations serving a rticular area, either around a mmon mast or at least on the e topographical prominence.

his makes it possible for receiv aerials in other areas to face per- nently in the general direction m which the signals come.

ery close to the stations, where signal strength is high, there is need for elaborate aerial arrays d adequate results may be ob- ned using something very simple leed.

igure 52 (a) illustrates a simple angement which has become pular overseas for high-strength nal areas. A moulded base, which on top of the cabinet, carries two ls, which point obliquely upward. he rods form the respective ves of a dipole aerial, which is nected to the receiver input ter- nals by a few inches of twin line. he oblique angle of the aerial ments is reasonably practical and orative and it has the advantage t a dipole with the elements in "V" formation is less critical in ms of operating frequency than in which the elements are end- end.

JUSTABLE

ormal practice is to make the s telescopic, and, in many cases, ustable as regards the angle of . The rods can thus be left at e intermediate length and posi- —if this happens to be satisfac- y—or else adjusted to favor some ticular station that may be aker than the others.

t does not follow, however, that h a simple arrangement gives optimum results anywhere in the house.

The presence of structural girders, electrical wiring, plumbing and other metal fixtures in the average house are sufficient to distort very markedly the field pattern from a VHF transmitter, particularly one operating toward the high frequency end of the allotted spectrum.

Superimposed over the plans of an ordinary dwelling, the field strength pattern from, say, a 200Mc station is reminiscent of the daily weather map, when numerous high and low pressure systems are disposed over the continent.

Field strength may easily vary in the ratio 100:1, with regions of high field strength only a short distance in the room away from regions of low field strength. This, in itself, is quite serious.

by W. N. Williams

What is no less serious is the fact that local reflections, &c, which are responsible for these abrupt variations in field strength, feed signals into a television receiver which are slightly displaced in time one with respect to the other.

This produces one or more "ghost" outlines behind the main image—an effect about which we shall have more to say later.

In such cases the placement of a set in the room may be quite critical if, at the one time, it has to be placed in the right spot and facing in the right direction from the point of view of the signal and yet conveniently located for viewing by members of the household.

The need to satisfy the requirement in respect to two or more stations, each having its own particular field pattern, only complicates the issue.

There are plenty of cases, of course, where placement of a self-contained receiver will not pose any special problem, but readers, who may later be concerned with the installation and servicing of television receivers, must become accustomed to such sharp variations in field pattern and to the importance of aerial placement relative thereto.

OTHER INDOOR SITES

To amateurs or others who have used VHF equipment in the past, this will not be anything new.

As an alternative to mounting the aerial on top of the receiver cabinet, telescopic elements are sometimes mounted in line along the picture rail, preferably facing broadside to the transmitting site.

Again, they may be mounted on the picture rail at the corner of a room to provide a horizontal "V", or around the framework of a doorway, with one element horizontal and the other vertical.

At best, the advantage of mounting the aerial in such positions, rather than on the set itself, would be slight.

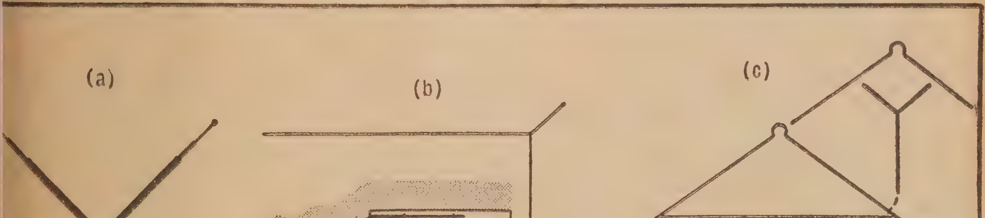
Where there is some doubt about the efficacy of an aerial within the viewing room, a definite advantage can usually be gained by placing it in a more elevated position—either under a gable of a non-metallic roof or actually above the roof and attached to some suitable prominence.

Remembering that all this still assumes an area of high signal level, a simple telescopic "V" aerial may be used or a folded dipole made up from rods or tubing or, yet again, from a length of twin lead supported on a wooden dowel.

A length of 300 ohm ribbon would suffice to connect it to the receiver.

Quite obviously, the final details

(Continued on Page 83)



igure 52: Illustrating three simple aerial arrangements for areas of high signal density. (A) is a telescopic "V" for mounting top the receiver; (b) shows a rod aerial attached to a doorframe, while (c) shows a similar aerial mounted under the gable roof of a typical house.

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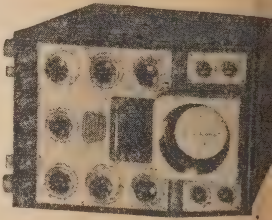

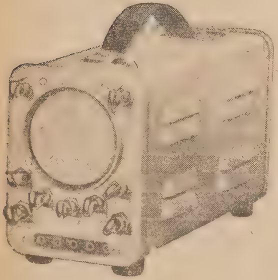

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EQUIPMENT FOR INDUSTRY AND RESEARCH

(Continued from Page 81)

f such an aerial cannot be settled ntil the receiver is installed and the tations are operating. However, uch aerials are so simple and cheap hat very little effort is required, ither to erect them in the first place r to modify them, if changes prove o be desirable.

The "average" receiving site —to rely on a rather loose term —would be more remote from the transmitting area and therefore served by signals of lower intensity. One authority quotes for this "average" area, figures of field strength ranging between 800 and 10,000 microvolts per meter.

Another authority suggests that omething like 80 pc of the potential iewing audience may be reckoned o fall into this "average" group.

For such localities, something beter is indicated, in the way of an erial system, than a couple of spikes rotruding from the top of the reeiver or erected in a not-too-favorble position at roof level.

The loss of signal pickup with such "primitive" aerial, on channels vell removed from its natural resoance, is likely to be serious in areas vhere the signal strength is only noderate to begin with.

Low signal input allows receiver oise to intrude, leaves the system pen to electrical interferences, and nvites trouble with ghost images, lue to mismatching and reflections n the aerial system as a whole.

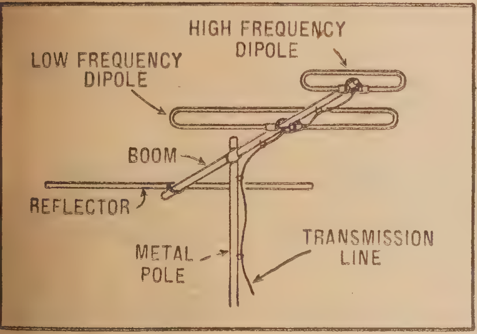

Figure 54: A popular all-band television aerial for areas of average signal strength. Performance varies from band to band but, in general, the signal pickup and directivity pattern is always better than that of a simple dipole cut for any one band.

Because a large proportion of the iewing audience is likely to live in vhat we have labelled as "average" reas, a great deal of attention has een given to the design of aerials o suit their requirements.

An engineer who sets out to deign an "average" type of receiving elevision aerial is likely to have the ollowing objectives in view:—

(1) The aerial must be a broadand type, therefore requiring no djustment as the receiver is tuned rom one channel to another.

(2) It should pick up ON ANY HF CHANNEL at least as much ignal as a dipole CUT FOR THAT HANNEL, and more if possible. Standard VHF practice is to comare an aerial's performance with hat of a simple resonant dipole.)

(3) It should ideally have a uniirectional pickup characteristic, oth to assist in achieving (2) and render the signal less prone to lectrical and "ghost" interference.

(4) Its characteristic impedance should change as little as possible from one TV channel to the next, so that a reasonable impedance match can be retained between the aerial, the transmission line and the receiver input. (This is necessary both to avoid loss of signal strength and the creation of reflections in the aerial circuit, leading to "ghost" images.)

(5) The aerial must be robust, proof against weather corrosion, of acceptable appearance, as simple to instal as possible, no dearer than necessary, &c.

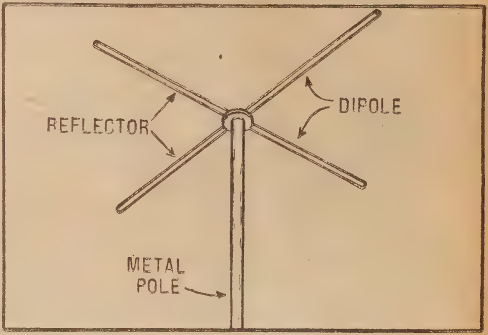

Figure 53: The so-called "X" aerial, which is actually a two-element beam all-band. It is well suited to mounting under a gab'e roof and ensures better signal pickup than elementary dipole arrangements previously discussed.

The result is likely to be a system which will cost the viewer at least £20 by the time the cost of installation and transmission line has been added.

Once again it is necessary to emphasise that reception conditions will not be uniform for all the houses in a given street or all the streets in a given suburb. There will be plenty of cases, where fortunate viewers will be able to receive adequate signals on a simple aerial, while others nearby may have to go to a great deal more trouble.

[It is anticipated that regional variations in signal strength will be much more marked in Sydney than in Melbourne, due to the hilly nature of the Sydney suburban area.]

The "average" television aerial required for the "average" installation has emerged as a two-element or three-element beam arrangement with proportions so manipulated as to give the required response over the VHF channels from about 50 to 200 Mc.

Several designs can be quoted, by way of illustration, typical of those which will shortly be launched on to the Australian market.

Perhaps the simplest of the group is the so-called "X" aerial, illustrated in figure 53.

In actual fact, it is made up from two "V" shaped elements mounted with their apexes together. The front or "driven" element is broken at the centre for attachment of the transmission line, while the rear element is continuous and acts in the manner of a reflector

The configuration of the aerial imparts to it a broadband characteristic, the elements normally being made long enough to resonate naturally near the low frequency channels and in harmonic mode near the high frequency channels.

It is well suited to mounting under a high, non-metallic gable roof, where reasonable elevation can be achieved without exposure to the elements.

Figure 54 illustrates a very popular type of outdoor TV aerial, which resembles in form the three element beam so favored by radio amateurs. Known as the "Yagi" aerial, this latter was illustrated in figure 51, in the last instalment of the series.

In actual fact, the TV version illustrated in figure 54 is not a true "Yagi" on at least two counts:

In the first place, the element lengths and spacing are not calculated on the basis of providing high gain on one particular frequency. Instead, they are manipulated to give usable response over as wide a range of frequencies as possible

Secondly, the forward element is not "parasitic"; that is to say, it does not rely for its directive properties purely on its size and position relative to the centre or "driven" element. Instead, it is actually connected to the centre element and to the transmission line.

BROAD RESPONSE

The basic idea behind this type of aerial is to proportion the centre element so that it is naturally resonant near one of the lower frequency channels—usually about 60 Mc.

The fact that it is a folded dipole broadens its response sufficiently to ensure reasonable results on channels adjacent to the one for which it is actually cut.

A further advantage of using a

(Continued on Page 85)

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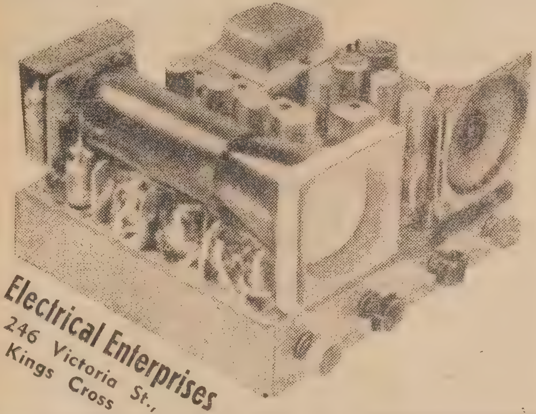

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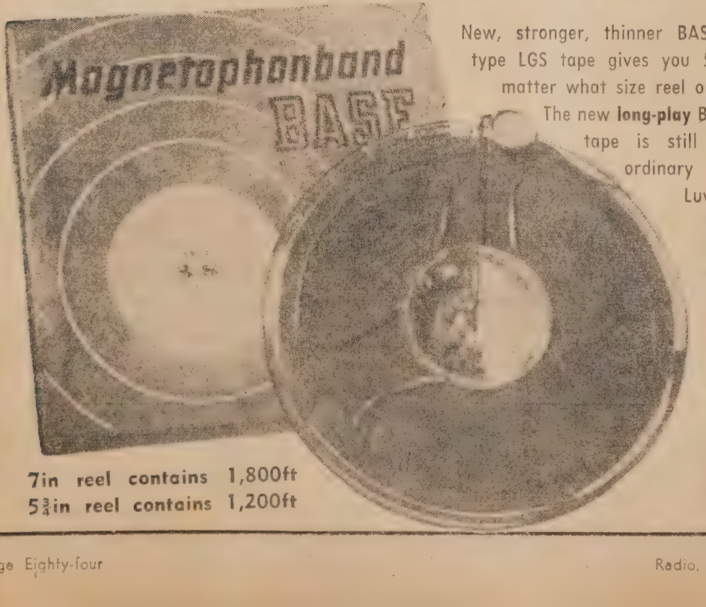

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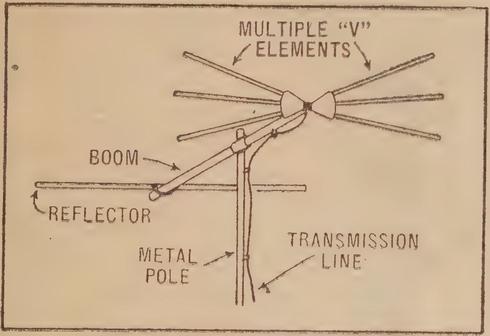
(Continued from Page 83)

led dipole as the centre element
in the fact that its characteris-
impedance is higher than that of
imple dipole, allowing it to be
nected to the receiver by means
the popular 300-ohm twin line
e figure 48a, last instalment.)

he rear element is a little longer
n the centre dipole and is in-
ded to act as a parasitic reflector
the "Low" channels. The array
efore favors signals arriving
n the small dipole end.

his front element is a folded
ole much smaller than the other
and generally proportioned so
it will resonate at a frequency
under 200Mc and therefore in
same portion of the spectrum
he "High" channels.



gure 56: A Fan
pe all-band aerial
nilar to the one
own in figure 55.
e two fan-shaped
ctions of the di-
le incline for-
rds. The aerial is
rmally used with
300-ohm transmis
n line and per-
mance is of the
ne general order
the 3-element
am shown in
figure 54.

he spacing between it and the
re dipole is also about one-
rter-wave at this frequency
eby gaining some reflective quali-
from the latter. Thus, once
n, the aerial tends to favor sig-
arriving from the direction in
ch the smaller dipole faces.

lthough this general form of
al is fairly universal, individual
ufacturers have their own ideas
ut optimum dimensions, spacing
connection of the feedline. In
e cases, the line is simply loop-
across from one folded dipole to
other and thence down to the
iver.

LATING CONNECTIONS

other cases, separate runs are
n from a selected junction point
he two individual dipoles. The
t lengths of transmission line
involved act as quarter-wave
ions which develop different im-
ance values at their ends at dis-
frequencies and partially iso-
one dipole or the other from
transmission line.

e object of such manipulations
ld be to obtain the highest sig-
pickup and the best possible
t-to-back ratio, averaged over
channels the aerial is required
eceive.

the same time, the impedance
he aerial array, as "seen" by the
smission line, would be held as
constant as possible, with a
to minimising reflections in
line and the consequent risk
ghost" images.

gure 55, at the head of this
le, shows a different type of
al, which has also proved to be
popular overseas for regions of
age signal strength. It relies for
road-band qualities partly on
ased area of the dipole elements
partly on harmonic resonance.

It is, in fact, derived from the conical dipole mentioned in our last instalment.

If a dipole is constructed with sheet-metal cone-shaped elements—apexes to the centre—it acquires a much broader response characteristic and a higher centre impedance. In other words, the conical form may be considered as an alternative to the folded dipole as a high-impedance broadband "driven" element.

Physically, however, a conical dipole constructed from sheet metal is both cumbersome and expensive and not very practical except, perhaps, for UHF television—with which we are not immediately concerned.

However, the characteristics of a conical dipole can be approximated with cones made from wire mesh or yet again from stiff wires assembled to form a conical cage.

Carrying the idea still further produces a dipole made from flat triangles of sheet metal, giving rise to the so-called "bow tie" aerial. This simplifies to a triangular mesh or wire grille and, ultimately, to the "Fan" aerial already referred to

It is illustrated diagrammatically in figure 56.

The fan-shaped elements are intended to increase the effective "area" of space intercepted by each half of the dipole. The elements are inclined forward in a shallow "V" (something over 100 degrees), further to broaden their response and to modify their impedance at the point of connection to the transmission line.

The elements are made naturally resonant at one of the lower frequency channels (about 60 Mc or a little higher) and exhibit harmonic modes higher up in the frequency range.

As with the three-element beam previously mentioned, the general idea behind the fan aerial has been adopted by many manufacturers and interpreted in various ways. Sometimes only two elements are used per side, instead of three. In other cases a fan-shaped reflector system is added instead of the single reflector rod depicted in figure 56.

FAN WITH REFLECTOR

The combination of a two-element fan with crossed reflector elements gives an aerial which virtually has two "X" formations attached to the ends of a horizontal boom.

Some justification can probably be found for most of the variations of

(Continued on page 87)

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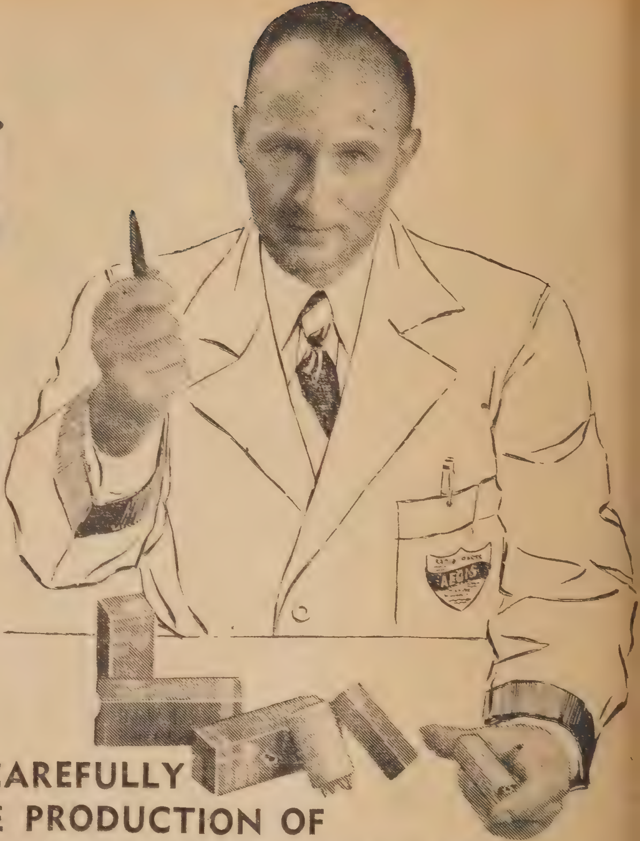

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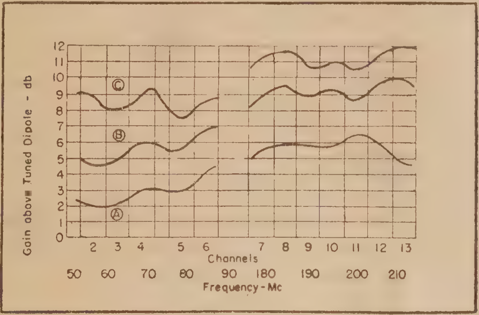
(Continued from Page 85)

th the fan type and the three-
ement beam array. Their per-
rmance varies a good deal from
ınd to band, but, by and large, they
eet the requirements of the "aver-
ge" installation—useful gain rela-
ve to a dipole, reasonable front-
ıck ratio, and no more than a toler-
ble variation in characteristic im-
dance.

The same could possibly be said
many other all-band aerial sys-
ms which have featured from time
time in overseas technical litera-
re. However, it is completely out
the question to try to mention
l the possible variants which have
en devised and which may con-
ivably make their appearance on
e local market.



igure 57: Perfor-
ance curves for a
ree - finger fan
erial, stacked for
inge area recep-
on. A, B and C
e for single, two
nd four - stack
rrays. In such
rays, spacing and
terconnection of
e bays are both
critical.

For more remote areas—generally
lled "fringe areas"—something
ore pretentious is required in the
ay of an aerial system.

It is desirable to achieve a better
ont-to-back ratio, both to reject
cally generated interference and
so to ensure a stronger signal from
e desired station.

TACKING

In some cases, an answer can be
und simply by "stacking" two or
ore standard all-band aerials, one
ove the other. Most television
rial manufacturers design their
rays so that this is at least prac-
able, the arrays being spaced by
me recommended distance and in-
rconnected in some recommended
shion.

By way of illustration, figure 57—
printed from an overseas journal
shows the gain figures which could
expected by stacking several
ree-finger fan aerials of a par-
ular brand.

The zero reference line is taken
indicate the signal level from a
nple, truly resonant dipole. Curve
is for a single fan aerial, curve
for a two-stack array and curve
for a four-stack array.

The gain is quite impressive,
ough such an aerial would not be
eap, by any means.

Other standard all-band aerials
n be stacked in like fashion and
ith proportionate results. Once
ain, it is not practicable to in-
stigate all the possibilities.

Mention should be made, however,
another approach which is often
opted in fringe areas. This is
ally a variant of the 3-element
am illustrated in figure 54.

Instead of combining the high and low frequency dipoles in a single array, they are separated into two distinct beams. One is proportioned to cater for the low channels, the other for the high channels. Two or three-element arrays are used and either interconnected at the mast head or else connected separately to the receiver through a selector switch.

To quote a typical set of figures, a particular all-band three-element beam proved to have an average gain of between 3 and 4 decibels relative to a simple dipole.

Separate high and low beams of comparable merit, gave figures which peaked to 11db around the 200Mc. region and 8db in the vicinity of 50 to 100Mc.

In other words, the results bore comparison with the four-stack fan array previously referred to.

Once again, the viewer who is forced to use a twin beam of this nature must be prepared to pay more for it than for a single all-band array.

Over and above these normal fringe area requirements are cases where viewers want a programme "at all costs", even though there is very little signal left to supply it.

In such cases, highly individual treatment is called for. It may be necessary to abandon all pretence at wide-band operation and to design a beam aerial in the way an amateur operator does—to give the highest possible gain, and the highest possible front-to-back ratio.

ACCURATE DESIGN

Stacked arrays may be called for, having a reflector and several directors in each bay. In such a case, all the classic aerial design formulas apply and extreme care has to be taken with spacing, interconnection and balancing.

If more than one signal is available, aerials may have to be erected for each separate channel, with separate cables running down to the receiver.

Fortunately, such measures are called for only in extreme cases.

Other special cases involve situations where strong "ghost" images appear, due to reflections from local hills or large buildings. Again, electrical interference may cause trouble, due to street wiring, &c., in line between the aerial and the television station.

Special arrays are valuable in such cases also, giving better than normal directivity in either a hori-

(Continued on Page 89)

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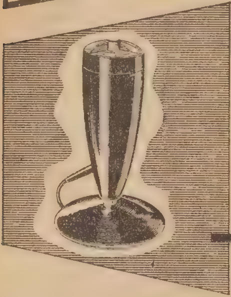

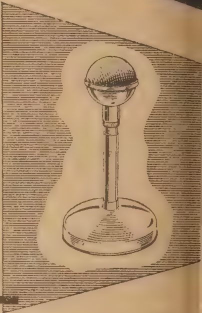

DESK or HAND MICROPHONE, MIC36

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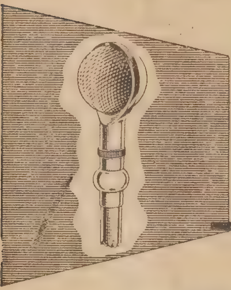
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



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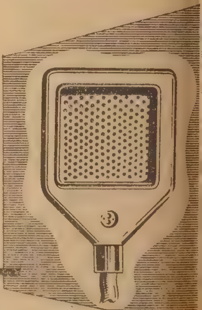

LAPEL MICROPHONE, MIC28

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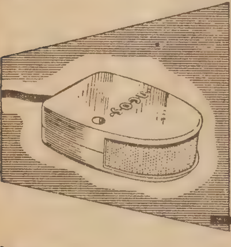

GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**

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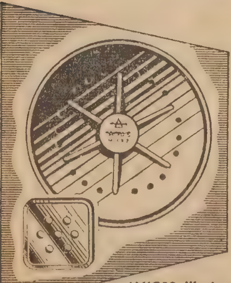
This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



(MIC32 illustrated)
(MIC23 illustrated)

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EPORT FROM THE EDITOR--ITALY--TV WITH YOUR COFFEE

Italy is a combination of marvellous beauty, extreme old age —and poverty.

ome, the Eternal City, lies in the is of dead glory—a glory decor- l with mighty and grotesque ues, by the incomparable cathe- of St. Peter, by the fountains ch catch one's breath with their ıty.

ess romantic but much more tical is the hair-raising speed ts motor transport, which would apoplexy, to an Australian ic cop. Baby cars predominate, l for the narrow, hopeless tangle streets, navigable to a stranger by means of a map.

ne Coloseum is a fantastic rem- t, a reminder of magnificence decay. Rome was not built in ay . . . and it can't be explored year.

AN, TV CENTRE

ilan, the modern, busy industrial lies over the plains of Lom- ly at the foot of the Swiss Alps, w hours from Berne. At present the centre of Italian TV, which 250,000 homes.

very hotel and cafe shows pro- ns for the price of a cup of ee, some have a projection en about 6 x 4ft overall.

ne such cafe, in fact, was using screens. One was a 6 x 4ft ection system which, while quite d to look at, lacked in contrast "body". At the other end of room was a 17in receiver, turned ft out" to achieve maximum bril- ce and blazing like a torch.

ctually only one of about 12 , which I have had the oppor- ty of watching for any length time, has been perfectly ad- ed. Most suffer from slight lulation of the picture in "Hula " fashion, due, I am told, to mains synchronisation through- Italy.

thers show dark bands followed white patches and vice versa. e sets need synchronising after ange in program and channel. rference problems in the city, ever, appear to be few.

OGRAMS TASTEFUL

ograms are tasteful and pro- d mainly in Rome, Milan, and les. The system is Government rolled, with a licence fee of ut £6 per year.

fter a quick look at the Geloso factory, I was able to spend an rnoon at the TV studios in n. Here there are four studios arying sizes, capable of holding -sized sets and closely resembling on picture studios.

ot much of the equipment is an made. It is imported mainly n Marconi in England, with a ll quantity from USA and nce.

ne studio is well equipped and es extensive films for later dcast. I met several Austra- s there—one was Kenneth Neate, "singing policeman". He was the cast of The Girl Of The den West, which was being re- rsed. Our mutual Australian nt came as a welcome change n Italian.

There are TV stations at Milan 200-207 Mc 5 Kw, Venice 61-68 Mc 11 Kw, Rome 200-207 Mc 5 Kw, Turin 81-88 Mc 5 Kw, Genoa 209-216 Mc 5 Kw, Florence 200-207 Mc 25 Kw, Trieste 174-181 Mc 25 Kw, Orvieto 209-216 Mc 1 Kw, Pisa 174-181 Mc 5 Kw, and Naples 61-68 Mc 5 Kw.

All these stations use super turnstile aerials, having figures of gain varying from six to 11 times.

Radio links provide for an interchange of programs using, at present, AM on about 240 Mc. Some degradation of bandwidths results from this practice but new and better links are envisaged.

Program schedules are along the following lines: 10 am-12 noon, test patterns and sound; 5.30 pm-7 pm, children's session, women's interests, &c.; 8.30-12 midnight, general program.

These night programs, at least the ones I have seen to date, have included a play from 9 to 10 pm, followed by a variety show. The plays have all been well done, if simply produced, and lean to the middle-high brow taste.

One night I saw a play by Chekov and the next night an Italian version of An Old Lady Shows Her Medals, by Sir James Barrie. The star of the piece, the old lady, was excellently acted, the play being highly emotional, in the Italian style.

As far as receivers are concerned, a 17in tube was the popular choice up to about 12 months ago. Now the preference has swung to 21in tubes, with a few 24in types.

Prices for a good, average receiver are about £105 sterling for a 17in model, £120 for a 21in and £180 for a de-luxe 24in job.

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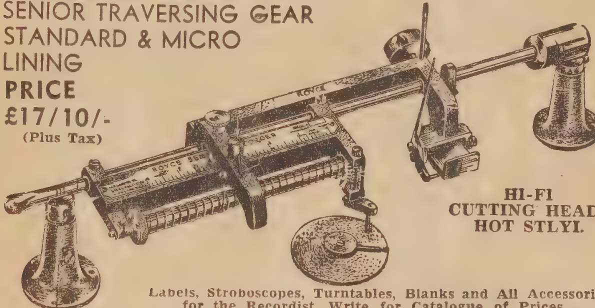

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6146

ideal for

Hams.

Mobile communications. Base stations.

Low frequency stages in broadcasting transmitters.

Medium to high power PA systems.

THE versatility of "Miniwatt" type 6146 tube has already made it famous overseas. Check its performance and you'll see why! Under I.C.A.S. conditions a pair in class AB1 will give 120 watts of audio—and it's an efficient tube up to 175 MCs. The wide range of applications of the "Miniwatt" type 6146 makes it a tube to remember!

Write for information and data sheets

PHILIPS

PHILIPS
ELECTRICAL INDUSTRIES
PTY. LTD.
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590 Bourke St., Melbourne, Victoria
148 Edward Street, Brisbane, Qld.
381-5 Murray St., Perth, W.A.
119 Grenfell St., Adelaide, S.A.

PV

TRADE REVIEWS AND RELEASES

HF TETRODE AVAILABLE FROM PHILIPS

One of the most popular transmitting valves available at the present time is the type 6146 beam power amplifier and Philips Electrical Industries Pty. Ltd. advise that they have ample stocks on hand at present.

HIS valve is featured in the
transmitter described elsewhere
this issue and proved itself to be
excellent performer. Similar in
eral characteristics to the 807 it
nevertheless, a considerable im-
vement on the latter.

Much of the improvement is due
better physical construction and
out, making possible much shorter
ds and consequently lower in-
tance. The older style "pinch"
struction as used in the 807 has
en way to the "banal" con-
uction, whereby the element leads
directly to the base pins.

he plate connection, to the top
, is no longer a single thin lead
a substantial metal strap con-
ting to the plate at two points.

nother contribution is the metal
ld around the base of the valve
which is connected to pin eight
earthing. This is a logical
elopment from the old "ham"
ge of dropping the base of an
below the chassis, thus allowing
chassis to act as a shield.

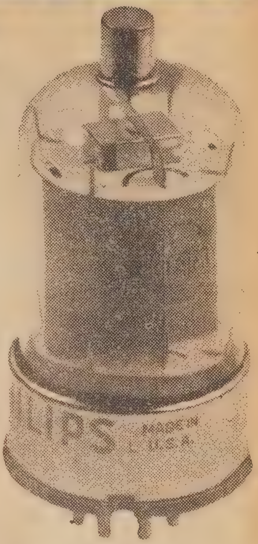
n addition the cathode—always a
blem connection—is brought out
three separate pins, thus further
ucing the effective lead length
inductance.

s a result of the lower inter-
trode capacitance and lower lead
uctance the maximum operating
quency has been raised to 175
s. Even at this frequency the
res are very attractive and the valve would appear to be ideal for the amateur 144 Mcs band or VHF mobile services.

The 6146 is also a very attractive audio valve, particularly for PA amplifiers and modulators. Operating under class AB1 conditions, two of these valves will deliver up to 82 watts (CCS rating) or 120 watts (ICAS rating). This order of power is more than sufficient for all amateur modulator requirements and most PA systems.

It is also physically smaller than the 807—only 3 1-8in from the bottom of the base to the top of the cap—and thus lends itself more readily to the compact construction which is the current trend.

Other details and data sheets may be obtained from the above firm 69 Clarence St., Sydney.



HEAT SINK" FOR
C72 TRANSISTORS

HILIPS ELECTRICAL INDUS-
TRIES also announce that they
now able to supply matched
rs of OC72 transistors with "heat
k" mounting strips in order to
ure the greatest possible safety
rgin for operation at their full
ver rating.

he heat sink takes the form of
mall metal plate, approximately
wide as the transistor is long, and
g enough to wrap completely
und the transistor and still leave
approximately square area of
tal plate protruding. This has a
tral mounting hole by which it
attached to the metal chassis. By
ping the transistor in close con-
with the relatively large mass
metal, in the form of the chassis,
is possible to improve the heat
ipation considerably.

ower dissipation in excess of 200
7 can easily be obtained using
s B and it is recommended that
2-OC72 transistors be mounted
a chassis not smaller than 2in by
to provide adequate cooling
ler these conditions.

I.C.S. TV CORRESPONDENCE COURSE

INTERNATIONAL CORRESPONDENCE SCHOOLS, a world-wide correspondence instruction organisation, have now made available in Australia a complete course in television servicing.

Instruction is by specially prepared brochures, each issue containing an examination paper covering the contents of the book. The student is required to send in the answers to the paper, which are then corrected and commented upon by the teachers.

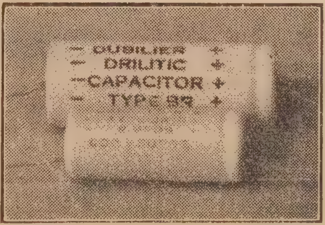
The instruction books are written by specialists in the particular field the books cover. The writers appear to occupy positions of some importance at various teaching institutions in America.

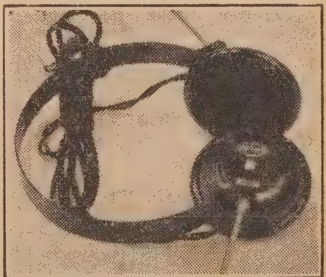
Considerable importance is attached to the clarity of the explanations and the books are amply illustrated. The books cover such fields as "TV Receiving Antennas", Principles of TV", "TV Receiver Installation" and "TV Test Equipment".

Judging by the instruction manuals submitted for our inspection the course should be of considerable interest to those wishing to be introduced to basic knowledge of TV principles.

Courses in Radio Servicing, Radio Technology and for entrance examinations of the IRE are also available from the school.

BRITISH CAPACITORS, EARPHONES





Phillips Agencies Pty. Ltd., 27 Hunter St., Sydney, advise that they are sole agents for Erpees headphones and N.S.W. agents for Dubilier capacitors. Examples of both products are shown above. The capacitors are at present only available in 8, 16, and 25 mfd, the latter being the low voltge type. Others may be indented to special order. Two types of phones are available, the lightweight (illustrated) at 39/6 retail and the type 1250 De Luxe at 85/-. Further details from the agents.

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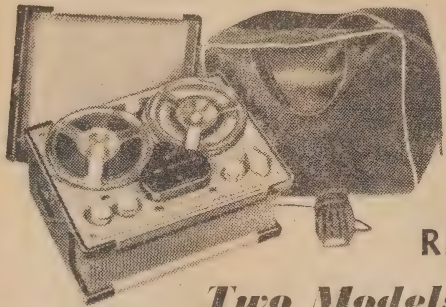

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Two Models To Choose From

"STUDIO" (Three speed, three motor, 7-inch reel) model with 2 heads or 3 heads. With a 3 HEAD Recorder direct comparison between the incoming sound and the recorded sound ca be made IMMEDIATELY, thus enabling the correct level, etc. 100 pc recording assured under all conditions.

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COMPARE FEATURES — COMPARE PRICES

and your choice will invariably be

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ONLY 38/6 per 1200ft

1st Quality Plastic Tapes — EMI H60 and others,
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MOTORS FOR CAPSTAN, take-up or rewind, £3/4/-.

To clear a few "MAGNEGRAPH" DECKS and RECORDERS left. DECKS (incl. Amplifer only) at greatly reduced price £58

RECORDERS, complete £85

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BUILD YOUR OWN 100 JOULE UNIT
SEE "RADIO & HOBBIES", APRIL & MAY, 1954.
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4/56

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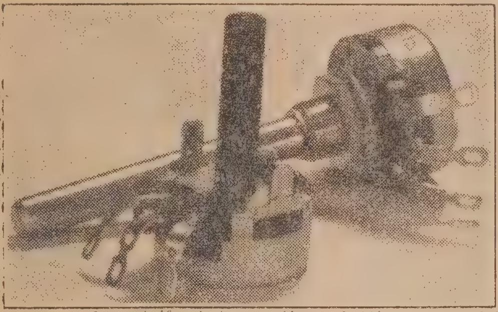
NEW MINIATURE IRC CONTROL

esignated "type Q", a new volume control only 15/16 inch diameter as been introduced recently into the I.R.C. range. Apart from its onsiderably smaller size, the type Q retails at 5/8 compared with 7/- for the standard type with which readers are familiar.



WIDE range of values ween 250 s and 15 gohms is lable and, ect to slight ification of resistance es available, noice of five rent taper aracteristics. er one or fixed taps the resist- element can be brought out if ired.

ie base is moulded bakelite with object of keeping moisture rbtion at a low level. The con- or is in one piece but the design ich that two independant con- to the resistance element are ided.

ie control is available with the l brass bushing and shaft ex- ing 1 7/8 inches, with other ths as specials. Locating lugs to d assembly. &c. are optional.

interest to manufacturers of ision receivers and other elec- c apparatus, requiring numbers preset potentiometers, is the ion of the Q type control with ated shaft. This shaft has a lded screwdriver slot either end at an adjustment could be made ssible in an otherwise impos- position. Insulated shaft lengths between ¼in and 1½in are available from stock with specials to order.

Where mass production and low cost are major considerations the Q type control with tab mounting will find application. The construction envisages that a hole with a slot either side be punched in the chassis and the unit secured by twisting the tabs.

In common with a number of other miniature controls the Q type does not provide a complete sealing against dust. However, it would appear that this is not a serious objection in practice as the controls are usually mounted in such a way that the entry of dust is not encouraged. Also the contact pressure is sufficient to remove dust particles after a few rotations.

Samples of both the insulated and brass shaft versions were supplied by Wm. J. McLellan and Co. Pty. Ltd., 126 Sussex St., Sydney.

AERIAL LECTURES WELL ATTENDED

at there is now an urgent interest abroad in television was evidenced the attendance at two recent lectures on television aerial systems.

E lectures were delivered on behalf of Antiference Ltd., ufacturers of TV aerials, by Mr. Lackey, Principal of the Aus- an Radio College.

e first lecture dealt with the working principles of VHF ls and with associated design lems. Only by appreciating the acteristics of such aerials can use be made of their character- to suppress noise and ghost ference.

. Lackey succeeded admirably nveying to the audience the im- nce of these problems, even h to many the discussion would broken new ground.

both occasions, the Grace torium was filled to capacity.

practical demonstration of the ent types of interference which ffect a television picture helped mphasise the theoretical dis- on and showed the importance lecting the right aerial for the

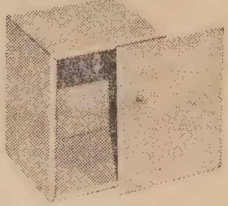
BOOK REVIEW

RADAR POCKET BOOK: R.S.H. Boulding. Stiff covers. 176 pages. Price 25/- plus 1/- postage. Our copy from Technical Book and Magazine Co., 295-299 Swanston St., Melbourne.

Radar installations are becoming increasingly popular in civil applications and the electronics engineer needs to be well versed in both operating principles and practical data. This handbook is intended to provide a maximum amount of such information in the most concise form possible. Profusely illustrated it covers from basic principles to typical modern equipment, together with detailed discussion of techniques perculiar to the frequencies involved.

This should be a very valuable reference book for any electronics engineer.

METAL UTILITY CABINETS



This line of cabinet is for housing electronic equipment of all types. It has fixed back and removable front. Basic colour is grey.

Catalogue No.	D.	W.	H	Price plus Sales Tax		
MC6	6in	6in	6in		8	3
MC5	5in	6in	9in		9	4
MC7	7in	8in	10in		13	9
MC67	6in	7in	12in		13	9
MC81	8in	10in	10in		17	0
MC811	8in	11in	12in	£1	1	0
MC79	7in	9in	15in	£1	1	0
SLOPING FRONT CABINETS						
SF7	7¼in	6in	6½in		11	6
SF79	7¼in	9in	6½in		13	9
SF71	7¼in	11in	6½in		16	0
SF8	8½in	13in	8in		19	3
SF10	10½in	18in	10in	£1	11	3
SPEAKER BOXES						
5in hole	7in	7in	4in		12	3
6in hole	8in	8in	4in		14	3
8in hole	10in	10in	6in		19	3

ANY CABINET, TO ANY SIZE.

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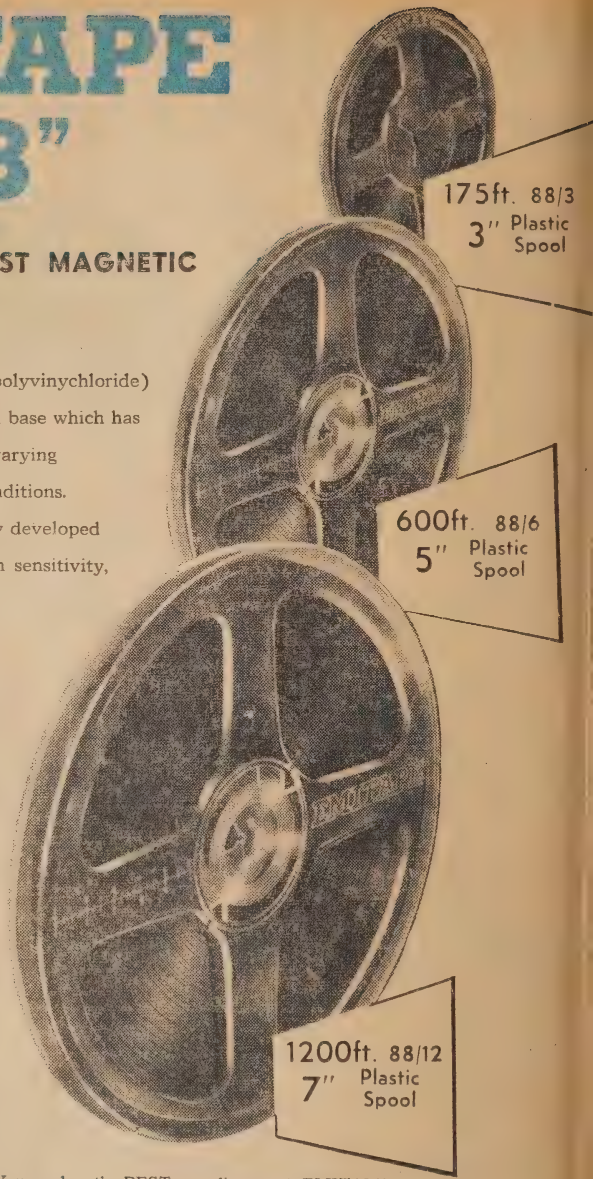

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"HIS MASTER'S VOICE"

MAGIC NOTES

COLUMBIA

PARLOPHONE

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E.M.I. (AUSTRALIA) PTY. LIMITED, ENGINEERING SALES DIVISION,
301 CASTLEREAGH STREET, SYDNEY, N.S.W.

TR.11.F

EW LIFE FOR LD AMPLIFIERS

Continued from page 55

oke lugs before mounting and ount with the lugs toward the top the chassis. This will avoid a ngerously placed pair of HT ter- nals.

The power transformer will norm- y have two filament windings, one th a centre tap and one without. ie one with the centre tap should used for the control unit and ner, the centre tap either being rthed or, in cases when using high in control units, connected to the thodes of the 6V6's. This helps reduce hum in very low level iges.

In purchasing new filter electro- ics we chose the chassis-mount- types in order to save space der the chassis. As it turned out ere is probably enough room to commodate the pigtail types, but u can please yourself. If the assis mounting types are used, it ll be necessary to drill extra chas- holes.

There is plenty of room for the nor components, even though most them are the old style "pre-minia- e" variety. Two eight terminal strips are mounted alongside the 7 and 6SH7 sockets and running rallel with the rear of the chassis. ey are approximately two inches art and a number of components y be mounted between them.

IRING COMPONENTS

These include the plate resistor the 6J7, the .05 meg, feed- ck resistor, cathode resistor and pass for the 6J7, and plate re- tor for the 6SH7. In addition h tag strip supports components, h as the .5 mfd screen bypass the rear one and the 1.5 meg. een resistor on the other one. ey also provide anchor points for er components.

A seven terminal tag strip is unted between the input and 6V6 ket and supports the 6SH7 grid. s and cathode load resistors, the grid resistor, the 6V6 grid re- tor, and the 2000 ohm decoupling istor to the six pin socket.

t is not a good idea to depend the steel chassis for an earth cuit and the various earth points uld be joined together with 18 ige tinned copper wire.

The finished amplifier should have ensitivity of 200 to 250 millivolts, ich is adequate for use with of the Playmaster control units. ng any of the valves suggested should be possible to obtain at st 10 watts of power output; more n enough for any home installa- n.

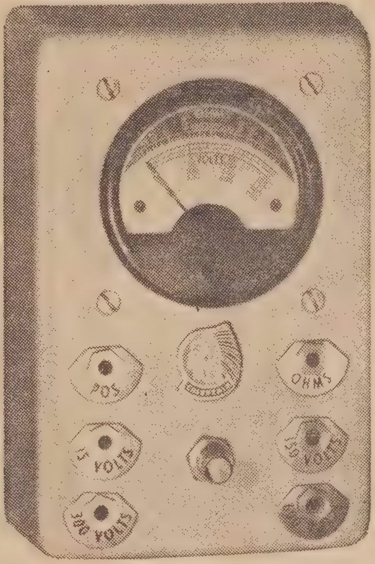
The frequency response will de- nd mainly on the output trans- mer, but even modest types uld give reasonable results. The we used, by no means the most ensive available, was only 4db vn at 20 Kc and 3 db down at cycles.

ll in all a very nice amplifier, for which you won't need to logise, and, more important, one can more likely afford to build n one of the more recent designs olving the purchase of all new ts.

introducing the **NEW**

Chieftain

MULTIMETER



★ Here is the new Chieftain Multimeter. Previously the meter was housed in a leatherette covered case. Now the case has been completely re-styled in smart durable white plastic, measuring 5½in x 3¾in x 2-3/8in.

The meter has 100 ohms internal resistance 1000 ohms per volt. Voltage reading: 0-15, 0-150, 0-300, 0-600. Ohms reading 0-100,000.

A smart pocket size meter ideal for the Electrician, Radio Serviceman, Motor Mechanic.

Price only £4/12/6

MOTOR SPARES LTD.
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Branches throughout Victoria and Riverina.

Let's Buy An Argument

Besides having had my "nose to the grindstone" this month, I have also had my head simul taneously "in the clouds". The explanation for this absurd remark lies in the rather length article, elsewhere in the issue, about television aerials.

WHILE poring over literature on the subject, one could not help but be impressed by a certain amount of humor, humbug and horror, which could find no place in a very formal "Course In Television". Hence the remarks here, where it is appropriate to say almost anything!

I was even commended warmly by one reader, a few months ago, for the brief venture into campfire puzzles—questions about pictures on the wall, train-guards shooting bullets and so on.

"KEEP IT UP"

This reader "regarded the innovation as a welcome change" and came right in with some puzzle about a possum sitting on top of a flag pole. I'm still wondering whether it added up to a compliment or otherwise.

But back to the subject.

Television "aerial humor" ranges from sketches of the most ornate arrays, erected on bag humpies, to the complaint of a witch on a broom about "these modern hazards to flying".

Then there was the remark of one very English hiker to another very English hiker, as they strolled through the street of a very English rural village; something to the effect "In these bally places, you know, the people never see a thing!"

Above their heads, ye anciente thatched rooves are thick with multi-element arrays!

And what of the humbug?

Well, it started when people conceived the idea of having a TV aerial erected on their roof to make the neighbors think they had television inside.

But it was a rather expensive form of deceit, so someone dreamed up—and marketed—a contraption that looked just like a real television aerial but costing only a fraction the price. If that isn't humbug, then I don't know what is!

by **Neville Williams**

It almost inspires one to mar a set of dummy garage doors, v black streaks to glue on to the cem path. The idea would be to impr the neighbors that you not c owned a car, but that it was enough and powerful enough to s the wheels on dry concrete!

Whether dummy aerials make th appearance in Australia has yet be seen but I imagine that Aus lians, as a race, are somewhat susceptible to such devices than American friends.

Still . . . you never know!

And what of the "horrors", I sp of earlier? Mainly, I think, they be induced when receiver engin and others get round to analysing detail the performance of practi all-band television aerials.

AERIALS ARE NECESSARY

Now don't get me wrong. A having filled several pages elsewh in the issue, saying how necess such aerials are, I'm not likely start in here to say the reverse.

Special receiving aerials are nec sary to capture signals from available stations at usable stren to feed those signals to the recei free from self-generated reflecti and also as free as possible from ternal interference.

And that's not by any means easy task.

I can remember the discussions had in the office a few years when local amateurs were "disc ering" the merits of high gain V aerial arrays. We would spend ho arguing about aerial impeda standing-wave ratios in cables, order of compensation for elem thickness, and effect, proximity other elements, height above gro and so on.

SMALL ERRORS

We were dreadfully concerned some miscalculation would render array resonant at 52Mc rather t 51Mc. And we worried about way performance might deterio as we moved a megacycle or away from the selected operating quency; or what the result would of using a slightly odd piece cable.

Then we'd turn to 144Mc and through the whole wearisome b ness again, speculating as to whe our observations on 50Mc would good for 144Mc.

I wonder how we'd felt if sudde faced with the proposition of ad ing our precious designs to w

oth frequencies—or any fre-
y in between?
we'd have had the green hor-
orthwith!

that's precisely the kind of
sition which faces the designer
television receiving array. In
's worse than that. He has to
his aerial work on any fre-
y from 50 odd megacycles to
200.

at's more, he doesn't have lots
tty charts to make the answer
gone conclusion. He just has
ale and fit till he gets some-
that works.

like trying to put together a
, into which somebody has
d several pieces that don't be-
But, unlike a jigsaw, the diffi-
ieces still have to be fitted in!

amateur, who has sweated
beam design for his own pur-
is likely to boggle at the prob-
nd goggle at the result, won-
how the hec anybody can
cile all these conflicting prob-
and come up with such pretty
g polar diagrams and claims
aerial gain.

POSSIBLE?

I must admit that polar dia-
can look very, very pretty in
book and gain figures look very
ssive, especially after having
"interpreted" by an enthusi-
advertising copy writer.

don't be dismayed too easily.
often as not, the polar diagrams
rectivity patterns—call them
you like—are idealised pat-
or, perhaps, measured patterns
an ordinary resonant beam.

y might indicate very nicely
a resonant beam can do—and
a broad-band TV array should
t they very seldom indicate the
of all the compromises which
had to be made in the latter's
.

ure 1 shows an idealised polar
am of a beam aerial and the
t can presumably be utilised to
a desired station and reject an
nted one. It came originally
an "Aerovox" paper and was
ited in our earlier television
e.

WARD QUESTIONS

certainly shows the idea behind
m but any VHF-minded "Ham"
be excused for asking certain
ard questions:

w, for example, the centre im-
nce of the driven element can
n anything like constant over
quency range of 4:1? What
ens when incoming signals find
element lengths anything from
quarter to a full wavelength at
own particular frequency? And
cable reflections &c. consequent
e above don't produce cable
ion enough to muck up com-
y the intended polar diagram?

me whisper a dreadful secret:
es! In plenty of cases, anyway.
e studied the measured results
complete broad-band arrays
can assure you that the patterns
look anything like as neat and
etrical as figure 1.

certain frequencies they're very
and selected curves, if pub-
l, might be quite factual. How-
they could also be quite mis-
g, if they carried the implica-
that the same directivity pattern applied at all other frequencies.

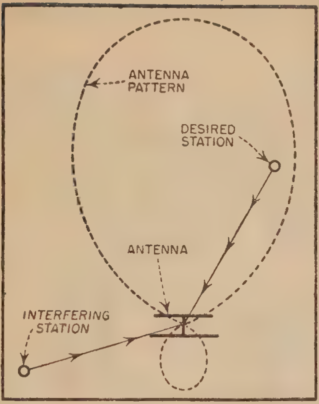

Figure 1: A typical idealised directivity pattern for a beam aerial. But will practical TV arrays be as precise as this in their selection and rejection of wanted and unwanted signals?

I've seen some of these patterns "at other frequencies". I've seen great lobes off the sides and off the back which would defeat the whole object of figure 1. It would be very easy to have one of these lobes squarely across an interfering source, in the fond impression that it was actually being attenuated.

Or, again, one could very easily meet the contradictory situation of achieving the best signal-to-noise ratio with the aerial pointing well away from the transmitting site.

Anomalous propagation? Reception by reflection? Phooey! Spurious lobes in the aerial system.

But that's not all. At certain frequencies the array may receive stronger signals off the back than from the front!

This is most likely to happen on the lowest frequency channel, where the reflector has become too short and begun to act instead as a director. The designer is likely to appreciate the point, but simply works on the assumption that there shouldn't be any problem, anyway, in getting good signals from the lowest frequency station.

But it could be a mystery if you weren't awake to the possibility.

In case you think I'm exaggerating the position, I present just one specimen curve of the response from an all-band array on the highest frequency channel. Its front response is actually less than it is 45 degrees to either side. And there's another big lobe out at 90 degrees to the right.

Quite by accident, this beam would duplicate the rejection properties of figure 1, because the interfering station or signal would fit into the trough at the lower left.

NOT SYMMETRICAL

But, alas and alack, if the interfering signal were coming from the other side at the selfsame angle it wouldn't work out. For best signal-to-noise ratio the beam would have to be swung anti-clockwise by about 40 degrees. This would put one corner of the frontal lobe across the desired station and a somewhat less pronounced dip across the interfering source.

Or, yet again, it might be possible to receive the wanted signal off the side of the array and use one of the other dips to reject the interference!

Imagine the dismay of a serviceman who'd never seen anything else but an idealised polar diagram.

"Ah, sweet mystery of strife, at last I've found you . . . &c."

Then there's another aspect to the whole matter which may give designers cause furiously to think. I refer to the allocation of channels here and abroad.

Most of the arrays which are destined for the local market appear to conform closely to American practice, because signal polarisation and channel allocation are comparable.

BUT . . . the majority of US television stations, if not all, are

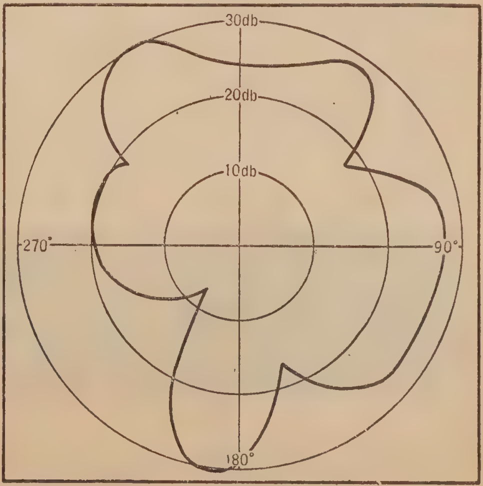

Figure 2: An actual measured response diagram from a perfectly typical all-band TV aerial. Non-resonant operation and radiation from the transmission line has completely upset its intended pattern. Unless awake to the effect, installation personnel might be excused for wondering why "High band" signals always seem to come from the wrong direction

Why it's easier to specify "Miniwatt" valves

"A VALVE for every socket" is much more than an advertising phrase to Philips. It is the embodiment of a production and merchandising policy to provide the widest range of receiving valves at all times. This policy in effect means that, in specifying "Miniwatt" valves, you can always be confident that your specification can be met. More, the consistent high quality of "Miniwatt" valves is further vindication of your choice.

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nodated in definite "High" or
bands—in the region below
and above 180Mc (in round
).

gives them two fairly well-
l regions for which aerial
s can be juggled. But here,
stralia, we have two proposed
els slap in between the Low
igh bands, viz., 132 and 146

st wonder how harmonic re-
hips and/or "High" and "Low"
s will fare in this megacyclic
n's land. Officially, of course,
n't have to worry about it till
, 1963.

it doesn't look too promising
e 144Mc Amateur band.

, speaking of Amateurs makes
onder how many "Hams" will
npted to try their luck with a
ion type array, stacked or
vise.

pe sure, the front-back ratios
ain figures don't look as good
pecialised Amateur band aerial,
ey're not the only things that
I can see quite a lot in
of a single, stacked array
can serve the family TV set
which, at other times, father
se to his heart's content on
IF Amateur bands.

ourse, if father is one of those
able creatures who prefers his
ur activities to communal
entertainment, then he'll just
o have his own aerial.

it's a thought!

ABOUT ORGANS

revert now to the subject of
, acoustic and otherwise, I
acknowledge several letters
have come to hand in recent

eemed at first that nobody
uch to say but such is not the
The letters just keep coming
l I couldn't hope to publish
all without banishing other
t matter from these columns.
be patient, we'll do our best.

Jung is quite happy to continue
gument with Mr. Tarrant but
isn't much future in this "I
. . no-but-you-said . . ." busi-
might be all right over a cup
fee but not in the pages of a
l, where space is always at
ning of a premium.

ever, Mr. Jung does make the
hat the principle of frequency
n, as applied to the generator
of an electronic organ, is not
rmous with economy of de-
He says:

my opinion the Minshall is
ly one in which real economy
from this type of generator.
the contrary, the Lowrey
employs twice the number of
for a one manual instrument
ne Baldwin employs for two
ls—there is no economy there,
s to the Baldwin, it certainly
nises in tubes, but the com-
of other circuitry and com-
s more than offsets its tube
ny.

way of passing, it is interest-
note that several of the elec-
organs are produced by manu-
ers who have for many years
d an enviable reputation as
organ builders. The John
on Organ Company who pro-
he "Electrone", one of the fin-
ctronic organs to date, are also
the largest organ builders in
n. Alfred E. Davies & Sons,
very old and respected English organ building firm, are the makers of the "Gregorian" Organ.

"In America the Wurlitzer Company, with a world wide reputation as organ builders are now entirely concentrating on the "Wurlitzer Electronic Organ", and the Estey Company, so well known for its reed organ and pipe organs, also builds electronics.

"All these organ building firms have had a long background which is especially useful to them in their research into the question of producing organ tone electronically, and in fact claim that their respective instruments are leaders in the field because of this experience.

"On the other hand, the Miller Organ Co. who manufacture the Constant Martin organ, also a very fine instrument, claims that it is because they have concentrated on electronics and totally disregarded pipe organ practice that they have been so successful with their pipeless organ."

WHY FOLLOW ACOUSTIC PRACTICE!

Dear Sir,

As an interested reader of the present "Argument" article, may I put a few questions to the experts in this field and venture a few conclusions of my own?

Why is it that most attempts to apply electronic music use the "organ" approach? The simpler monophonic type instruments seem to be neglected, even though acoustic instruments of the single voice type hold a high place in the musical scheme of things?

I cannot help feeling that there is good reason for the "organ" trend. Despite recent advances, electronic music has not yet reached the point where all the subtle expressions of say the violin can be obtained using the electronic approach.

Although instruments like the Solovox and Clavioline are capable of imitating a wide variety of single voice instruments, there is a mechanical quality in their music which, although adequate for "popular" playing, would not allow justice to be done to a Mozart concerto.

Much of this lack of expression can be attributed to the use of a keyboard. Is it really the best way to link a player with his instrument? It may be so in acoustic instruments, but in the electronic field we have the chance to produce a simpler and more flexible method.

A good example is the now obsolete Theremin, where the pitch of a note was varied by the position of the player's hand relative to an oscillator coil. True it was crude, but it represented an attempt to break away from acoustic traditions.

Elimination of the keyboard would be a boon to home constructors, who are a little tired of articles which begin "First get your keyboard". I realise that commercial makers of electronic instruments must build in this way to have a market of ready-made players, but no such limitation is placed on the backroom experimenter, who may not be able to play the organ anyway!

It is in this field that the home constructor will meet most success. We do not need to copy slavishly orchestral instruments, but we do need these instruments as a basis of study until all the factors contributing to the making of fine music are understood.

Remember the time, not so long ago, when the importance of formants was not fully understood. I have an idea that, in a few years time, we shall be in possession of facts about the production (and reproduction) of musical sounds which will drastically change the ideas we hold at present.

Here is a chance for experimenters to make important progress. The situation could be likened to the 1920 era when "hams" using their own equipment, carried out experiments which startled the world.

I suggest the following programme for investigation:

(1) Produce a simple method of varying attack and decay which is as flexible as a violin bow. It must be under the control of the player at all times and must be continuously variable.

(2) Produce a simple method of varying the pitch, preferably continuously variable. It must be as easy to play as a keyboard but with that degree of flexibility which a keyboard cannot supply.

(3) Provide a method of varying the frequency and width of the formant band. This must be independent of the generator waveform.

(4) Bring the instrument down to portable size with say a single-ended two-stage amplifier, with a single loudspeaker and a speaker-silencing headphone jack for practising purposes.

Perhaps the conclusions I have drawn are at variance with general opinion, but I feel that the above approach is worth spending some time on. (R. L. MacLeod, Vic.)

A COURSE IN TELEVISION

(Continued from Page 87)

zontal or a vertical plane. Readers can expect discussion of such problems in other articles at a later late, as they become urgent locally.

But there are many other aspects of the whole question which must perforce be left to another time.

There is the question of siting aerials on buildings, the mechanics of attaching them, the choice of transmission cable, the problems of running the cable to the set, ways and means of dealing with unequal reception on different channels, of dealing with image "ghosts" and such like.

With all these things the progressive TV engineer and serviceman must ultimately become acquainted.

(To be continued)

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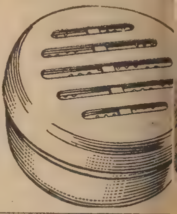

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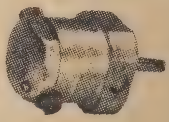

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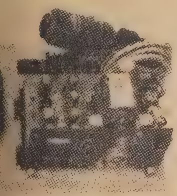

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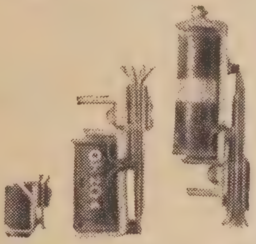

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le S.T. 6/6
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h are suitable for the
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three acorn sockets
amic) and two new 955
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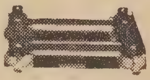

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OFF THE RECORD — NEWS & REVIEWS

Perhaps the most interesting item of news for the current month is the announcement b
Philips Electrical Industries that they have acquired sole marketing rights in Australia f
records issued by Deutsche Grammophon Company. Their labels include Deutsche, Grar
mophone, Polydor and Archive.

by John Moyle

PRODUCTS of the Deutsche Grammophon Company are well known for their high technical standard and for the quality of the artists whose names appear on the labels.

Featured artists include Wilhelm Kempff, Irmgard Seefried, Monique Haas, Wilhelm Furtwangler, Eugene Jochum, Igor Markevitch and David Oistrakh.

Orchestras include the Berlin Philharmonic and the Munich Philharmonic.

Polydor is well known for its array of Continental artists, notably Crazy Otto, Ricardo Santos and "pop" singer Caterina Velente.

The Archive catalogue contains a series of records specially chosen for the connoisseur and presenting the gamut of western music from its very beginnings up to the period of Haydn and Mozart.

The first discs under the new arrangement are scheduled for release this month.

VERDI—Rigoletto, with Mario del Monaco (tenor) Aldo Protti (baritone) and Hilde Gueden (soprano) with the Chorus and Orchestra of L'Accademia di Santa Cecelia, Rome, conducted by Alberto Erede. Decca LXT 5006-7-8.

This opera as a performance is quite good on the whole, but it tends to be uneven and patchy.

It contains some of the most popular of all Verdi's arias and duets, not forgetting the famous quartet at the commencement of Act III.

It may be natural, therefore, to pay special attention to these, with the danger of losing dramatic shape in between them.

At any rate, this is my main criticism of the performance.

All the main characters share in it.

Aldo Protti as Rigoletto does most creditably in all his high spots, but in between he lapses into a steady dramatic style which has very little light and shade.

The tenor, del Monaco, is quite the most colorless of the principals. His powerful voice dominates all his scenes, not only because he is obviously determined to be heard, but because the microphones are equally determined to aid and abet him.

Although he has possibly the leading arias, and certainly the best known, he sings them in such a way that I wonder whether he can with safety lower the pressure. His portrayal is of a swaggering, insensitive
braggart, with none of the flexi
and romanticism essential to
tain full conviction in the pa

I could not help reflecting
to the way Caruso sang the
The comparison was an unl
one.

Hilde Gueden is a sweet an
figure as Gilda, but she com
life only in spasms. Maybe
and vitality don't go togethe
there is little more than pret
to be heard here.

On the other hand, the
characters, without exception
good. Cesare Siepi as Spara
the assassin, not only has a
nificent voice, but also an adm
theatrical sense. Fernando C
as Count Monterone is anothe
fine singer who fills out his
The quartet from Act III
mind didn't work out very

NOT BALANCED

The voices, ranging from the
strength of Monaco to the
thin voice of Hilde Gueden
comparison at any rate—re
some compensating micro
placing, and you can't do tha
several voices and bring the
blend. Gueden, and particula
mezzo singing Maddalena, we
forward, and the latter's s
interjections registered rathe
fortunately. And just as
expecting a high-note finish, t
came down instead of up—ar
climax, but at least in tune.

The orchestra is unobtru
good—not strong enough to ta
honors, but rarely lacking in
and with some most effecti
delicately placed wood-wind
ments which are so effective
cluded in the score.

The recording is not in t
flight, at least as far as Mor
concerned. You may need
the RIAA or the EMI curve t
off a suggestion of blasting fr
powerful notes. This mayb
comment against many goods
moments, but today's records
be able to produce even a
in top condition.

SONGS OF STAGE
SCREEN — sung by Ric
Tauber, including My
and I, One Alone, The En
Rose, We'll Gather Lilacs,
Come Back to Me, One
When We Were Young,
Ago, Sympathy, Dearly
loved, and Can I Forget
Parlophone PMBO1009.

Some of Tauber's justly
songs re-recorded with a
mostly missing from the
78's.

Most of these originals I
almost impossible to play
—toward the centre their
deteriorated except with th

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A high quality engineered unit with a superb finish.

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- Anti-rumble ball thrust.
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of pickups, and often were sfactory, anyhow.

these, although lacking in the quality of recent vocal regs, are at least free from dis. Their response has delily been limited and they sound dull as a result.

it's Tauber, all right, and gh the vocal tricks are as ing as ever, those who love nging will welcome the disc. EMI curve is best, and suroise is extremely low.

USIC BOXES OF LONG O—American Music Boxes of Nineteenth Century. Cook .

the home of George and eine Brown, in New Jersey, is a wonderful collection of ifferent musical boxes, those ing, bell-bestowed mechanical els which supplied music to orefathers, denied the blessf radio and the gramophone.

y hold an honored place in istory of mechanical music. contained the idea not only dividually keyed notes which and in another form was the of the pianola, but also of revolving cylinder and disc , with the engraved surface, the modern gramophone re- We should not forget that whole conception of presentecords and reproduction from is purely mechanical.

ory Cook has done the job rly, with a list of the various used for the record, eleven , and a key to show on which each selection was played.

ne of them are most surprisfull in tone, and some feature and silver bells which are k at appropriate key notes. s supply amusing mechanical and whirrs which, far from cting from the effect, only make tmosphere more authentic.

s quite a charming record, and thentic "Sounds of Our Times" e true Cook tradition, even if imes date back about 70 years. hnically, the recording is first and with twenty-six selections vo sides, no one can complain he hasn't his money's worth.

PEED THE PARTING EST—Hi Fi In A Chime Shop, kle Little Bell, Hongkong al, Drummer's Parade and ppy Little Woodpile. Conted, composed and arranged Jimmy Carroll. Cook 1041.

ictly for sound addicts, this was of the earlier records which d to give Emory Cook his . All selections are played by thm and effects orchestra, with use of drums, xylophones and some expert paper and comb.

ording to the list on the cover, are about 100 units of all used, with nine experts to them, dodging from one set other to follow the "score". a matter of fact, this referto a score isn't really ironical. is a score to all of them, and st skilfully arranged one at Tinkle Little Bell and Happy Woodpile in particular have really melodious moments, but tation of sound is the main .

name comes from the first noisiest selection intended to hurry on his way the hi-fi guest who looks like camping for the night. Frankly, the sound isn't quite as hi-fi as we can get as of now but it has real quality to it and there is plenty of impact.

I heard this record some time ago in its binaural form and it was even more impressive.

There is some hum audible from the disc when played at high volume, as it should be because the amplitude isn't high.

Good for you, Emory!

BEETHOVEN—Symphony No. 1 in C major Opus 21. Played by the Vienna Symphony Orchestra, conducted by John Pritchard. Philips S06037R.

The main attraction of this record is that it is an inexpensive way of obtaining a good average performance of bright Beethoven.

It does not equal the smoothness or subtlety of several other recordings available on larger and more expensive discs.

The sound is bright, but it has a dry quality which goes with rather a straightforward performance.

The surface is OK, and either the EMI or RIAA curve sounds best. Some bass boost might help the bottom end, but its a bit light on in that region.

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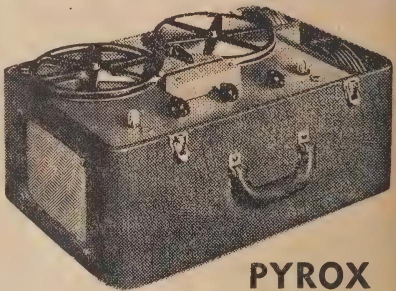

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:ETHOVEN — Overtures
io, Leonora Nos. 1, 2, and
layed by the Philharmonia
estra, conducted by Otto
nperer. Columbia 33OCX1270.

only direct competitor is an
Westminster of the Vienna
conducted by Hermann
hen. The difference is very
one of approach, because
by today's standards, the
hen record is good.

rchen is more analytical and
s less enterprising than
erer, who exhibits a passion-
te, most apparent I thought
Leonora No. 3, and least of
Fidelio.

the task of comparisons is
a little more than most
ing reviewers can cope with
lays. It would take hours to
ice to every version of these
vertures I have on the shelf.
say however that the No 3
sed me more *in toto* than did
u s, mostly because Klemp-
chieved this extra touch of
which Karajan, for all his
competence, didn't reach.
lly the players in each case
same, which makes it even
It might even be that this
s the best yet, and certainly
hlight of this disc.

ed the overall sound of the
erer record better. It had
f the warmth missing in the
n disc, while retaining the
al impression of size.

fairest comment I can make
re is to say that this disc,
ly and sonically, gains high
The comparison and con-
etween the four items is ex-
ally interesting, the sound is
the performances equally so,
e surface first rate. If you
his music, I'll guarantee you
be disappointed in it.

ETHOVEN—Symphony No.
C major Opus 21, Egmont
ture Opus 84, Leonora
ture No. 3 Opus 72A. Play-
y the Philharmonia Orch-
, conducted by Herbert
Karajan. Columbia
X1136.

is an extremely good un-
cated performance of the
ony. It is bright and yet
, a little fast in overall pace,
hard driven into excitement,
king up for it with excellent
.

n to the perfect precision of
al chords at the end of the
novement, and the delicate
n the last.

second movement is taken at
pace which is the way I
— too often is it prolonged
riable tempo and exaggerat-
amics which sit unhappily on
ulders.

recording balance reverbera-
d so on are first rate, but I
have liked more body in the
end. But I wouldn't for a
t quarrel with the spatial
nd feeling of breadth that is
al to Beethoven. A closer
ng might have sacrificed some
as it is we get that concert
ect.

surface crackles annoyed
they may have been on this
ly.

mic range is good, fre-
range is average Columbia.
repeats seem to have been
.

brisk pace continues with the
Overture on the reverse
ere some heavier weight is
usual and would have been an improvement, but otherwise most of the drama is well done, particularly the horn sections just before the finale, which ends with a great air of excitement.

A fine performance of the Leonora No. 3 rounds off a disc which will be hard to pass by for quality and value.

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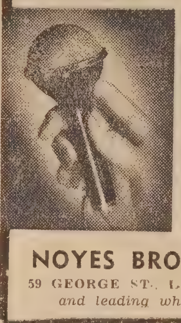
And Stefano's impetuous love-



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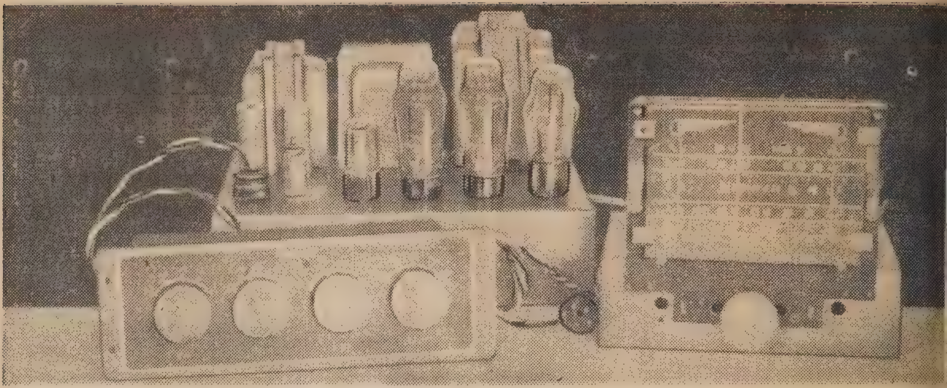

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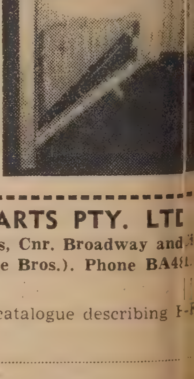

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g doesn't altogether overcome
npression that he is a heart-
d after all, going into the af-
vith more calculation than

em to remember some news-
controversy on these points
months ago when perform-
of the opera were being given
lney.

regarded purely as a musical
nance, there is without doubt
ovely singing. It is of course,
around the soprano part, and
ensely moving part at that.

n other operatic recordings, I
tefano reaches his limit be-
e soprano — he strains a bit
pressure or when going for
one. On the other hand he
ably as good as any recording
today.

oria de los Angeles has a
dramatic sense, but it is a
ooded Italian style which as I
aid is rather strong stuff for
anese girl. Accept that and
ill love it.

ticed Tito Gobbi again doing
s Sharpless, but then all the
characters give good support
orchestra shows the reverb-
of the Rome Opera House.
elps to dispel that studio air
e so much.

od release and a full blooded
echnically you need have no
s — my copy is free from any
blemish.

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er Gieseking. Columbia
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therefore could be the short-
iew on record.

merely a truism to say that
ing excels in Debussy. I doubt
r any other performer has
such unanimous praise for
rformances on a given com-

n't just a matter of technique
or that. It is an undefinable,
nt quality of sheer magic, the
all these things, that creates
sonic magic.

servedly recommend.

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to the Queen, played by the
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was written as a ballet to
morate the Coronation of Her
y Queen Elizabeth II and per-
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ny at Covent Garden.

as six sections—Prelude and
g Scene, Earth, Water, Fire,
d Finale.

story is a conventional one
all these things paying their
e to the new Queen.

best that can be said is that
ell above the average moving
symphonic music, but that
se it perhaps depends greatly
glittering spectacle to hold it

e is much competent writing,
nt and joyful noises, and
riate laudatory moments, but
rdly the kind of music you
ant to hear often.

eral recording is good, the sur-
so, and it passes into the lib-
good stock material.

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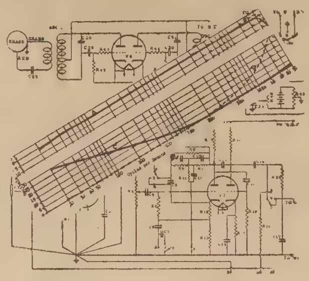

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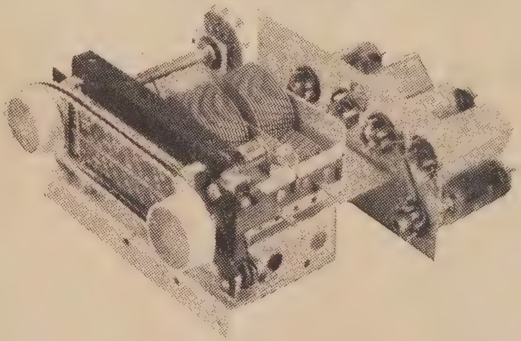

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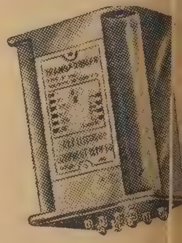
ohms.



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(Continued from Page 71)

d 3mA. On the lower fre- bands there will probably sufficient reserve of drive to he grid current meter past ale but it would be most un- o operate the transmitter in ndition.

no aerial connected and the rcuit tuned to resonance, the e plate current as read by eter will be low. Then, as mber of turns on L3 and its ity to L2 is increased, the m plate current will increase ergy be fed through to the

not possible to go on in- g the loading indefinitely be- point will be reached where ings of the valve will be ex- and, in fact, the energy fed aerial actually decreases with lues of loading.

NG

a 400 volt high tension sup- greatest energy will be fed erial with the loading adjust- at the plate current is about A. With a 600 volt supply issipation is likely to be the factor in obtaining power and the manufacturers sug- at the maximum loading be . These ratings apply to the erated as a plate modulated r.

keyed amplifier, higher in- e permissible and the high may be increased to 750 nd the loading to 120 mA an input of 90 watts. This is one which we may dis- rther at a later date when could be made of key click &c.

DC supply for the final am- is applied through a radio cy choke in order to avoid the DC plus RF potential g the tuning capacitor or the frame of the capacitor gh DC potential.

equirements of the choke are have a high inductance, low apacitance and the ability to he 100mA or so plate current stress. The ideal choke probably be made up of a of pies of progressively sizes approaching the high end.

FFICIENT

ied some locally made chokes showed some signs of heat- e percentage of power wasted y to be small but you may worth while checking with s dealers with the idea of g something more suitable.

w loss material is required tank coil formers one of s 1¼in diam. and the other m. We used lengths of poly- rod which happened to be d but this is likely to be ve if bought in the normal il formers of these diameters as plentiful as they were a rs ago but it should still be to gain them. For the smaller least, it would not be im- ble to make it self support-

job of winding the coils s made much easier if you n a shallow spiral groove on the former in a screw cutting lathe. On the other hand, if you do not have such facilities, the difference is likely to be mainly a matter of appearance.

We will not attempt to discuss a suitable modulator for the transmitter in detail at the moment. Briefly, it should be capable of producing audio power equal to half the input to the final stage, on peaks at least, and the load impedance should be matched to the class C amplifier

UNDER THE DESK

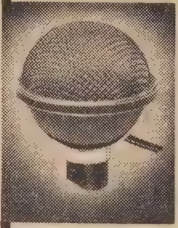
If you decide to install the transmitter in a desk cabinet, the modulator could be combined with a power supply on the one chassis and placed under the desk or somewhere out of the way. On the other hand if you prefer the rack and panel construction, the units may be made on separate chassis to match the transmitter.

With the circuit arrangement as shown, the power supply is required to deliver up to 170 mA at between

(Continued on Page 125)

AWA RONETTE

MICROPHONES & ACCESSORIES



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MINI-MAX

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SHORT-WAVE NOTES BY ART CUSHE

RADIO SAIGON CLOSING DOWN

The closing down of Radio France Asie, or Radio Saigon as the station is better known, came as a shock to listeners.

RADIO SAIGON has been operating for the past 20 years, and following the Vietnam crisis the slogan became Radio France Asie, the Voice of France in the Far East. The station became a friend to most shortwave listeners and the regular letter box programmes and special DX sessions were a feature of their broadcasts. Being a two hour 30 minute service to Australia and New Zealand, the station was well known to many listeners.

LETTER FROM SAIGON

Mr. Jean Varnoux, Director of Radio France Asie, Saigon stated —" I have the honour to inform you that the Vietnamese Government has decided to establish a State monopoly of broadcasting. This decision involves the cessation of broadcasts by Radio France Asie which, under the authority of the French Government, was permitted under the Franco Vietnamese convention of 1949, to broadcast on Vietnamese territory.

"I therefore regret to inform you that Radio France Asie, will cease broadcasting with effect from February 27, 1956. I wish to thank you for the interest you have always taken in our work, and the advice and encouragement you have given us with a view to the improvement of quality of our programs."

TAIWAN VERIFIES

OUR recent list of the private lower-powered stations in Taiwan, has been the means of reporting many of these stations and the subsequent verifications provide much interesting information.

BEC27, which now operates on 720 Kc is the station of the US Forces in Taiwan, broadcasting from Taipeh.

An airmail verification letter from Frank Huntley states the station is operated as a spare time venture. The station, a military one, is operated under the Military Assistance Advisory Group and is very limited in operation. All the announcers heard on BEC27 are on a voluntary non-reimbursible basis.

The transcriptions are sent to the station by the AFRS at Los Angeles. Huntley is announcing between 7.00-9.00 pm Thursday, Saturday, Sunday. This is in addition to his work with Northwest Airlines.

BEC23, Military Broadcasting Station, Shih-fu Rd., Taichung, Taiwan, confirms the reception of their broadcasts on 7140 Kc. The station has a new schedule, 8.00-11.00 am, 1.00-4.00 pm, 7.00 pm-2.00 am.

BEC36, Taiwan Police Broadcasting Station, Tientsin Road, Taipeh, confirms reception by letter from C. Y. Juan. The station is using 5960 Kc and is best heard at 9 pm. The station is particularly pleased to receive reports from this area and, in the verification, enclosed a book on the 1955 issue of Taiwan stamps.

ILOILO CITY ON 85 M.

AFTER being heard in Melbourne for several weeks, we have at last been able to identify DYI2, Iloilo City on 3325 Kc. The station is a relay of DYR1 on 1285 Kc and has been heard to sign off at midnight. On Saturdays the program consists of a request session until the station signs off. Signals can be heard from as early as 8.30 pm and are never at a very strong strength. This makes the third Philippine station on 85 metres. The others are DZB2 3340 and DYB4 3275 Kc. The station is operated by the Visayan Broadcasting Company, Mailing address PO Box 66, Cebu City.

Activity in Indonesian radio circles in the past few months has seen greatly increased power for many of the regional transmitters.

Listeners in this area in the past have looked on the stations of Radio Republic Indonesia as providing some of the most interesting dx listening, mainly for the low power of the regional stations, most of these using 100 watts and less, and many using the low frequencies in the vicinity of the 2000 Kc section of the shortwave band.

Over the past few years most of the main centres of population have had a second station added to give an alternate program and, in most cases, the power of transmitters have been stepped up to 1000 watts. Some 52 stations now operate in the local regional services and they range from the 100,000 watt GEC YDF transmitter at Djakarta, which is also used in the Overseas services, to the low powered YDN at Kotarafa Sumatra using 100 watts

ART CUSHEN ON SBC

AN interview with the writer will be heard in the May program of the Swiss Broadcasting Corporation in Berne in the special program for DX listeners. The interview, recorded in Invercargill, is between the writer and Drek Moris, the latter asking the questions on DX conditions in New Zealand and the facilities enjoyed by listeners.

The broadcast from Berne will be made on Friday, May 4, at 5.45 pm for Eastern Australia and New Zealand, with a repeat at 7.30 pm. Frequencies of 11365 and 15315 Kc are expected to be used. This monthly DX program is conducted by Russell Henderson and is broadcast in nine transmissions directed to all continents.

INDONESIAN CHANGES

THE latest information from Djakarta, states that following are new changes, YDA3 (4945) Bandung now 3.000 W, YDJ3 (2350) Djogjakarta now 1000 W, YDG3 (3286) Madiun, has 150 W, YDL (3960) Padang now 10,000 W, YDN2 (4985) Kotaradja is increasing to 5,000 W, YDP2 (2490) Medan to 1000 W, YDP3 (7195) Medan to 20,000 W.

A new station is YDM6 on 3241 Kc at Sibolga, Sumatra using 300 watts. YDQ3 (7295) Makassar has a new 20,000 W transmitter, and YDQ2 (9550) remains at 3000 W instead of the increased power authorised to 20,000 W. YDS Menado will increase to 5000 W on 3214 Kc. YDX is a new call for the transmitter at Tandjong Pinang operating on 3223 Kc with 300 watts.

TR1 has central headquarters in Djakarta, and has other stations classified as Central, Regional Local and relay stations and these employ a staff of 1940 persons. The Regional stations are located at Bandung, Dogjakarta, Surakarta, Semarang, Suragaya, Medan, Padang, Palembang, Bandjarmasin, Makassar, Dempasar and Ambon. There are seven local stations and the balance are relay units. Indonesia has an estimated five-million receivers in use.

Most of the transmitters employ omni-directional aerials, except YDF and YDC which use special directional aerials to cover the whole of Indonesia. YDE and YDB3 both use rhombics to give good reception in East Java and Sumatra respectively, while the YDF for its foreign programs uses a reversible curtain antenna for Australia or India or Europe.

The program content is generally made up of English or American recordings or recitals of the local gamalon orchestras. Sign off time is 1.30 am in the case of the Indonesian stations in Java, 1 am for the Celebes and 2 am for the Sumatra stations. March and Hawaiian music is popular in the programme content, and most stations relay the news from Djakarta at 12.30 am. A clock chime is used by many stations on the hour and is a regular feature of the Djakarta transmissions.

FLASHES FROM EVERYWHERE

RADIO ABIDJAN, at Abidjan
Coast, confirmed our reception
broadcasts on 4945 Kc, the fre
which now employs 10 Kw. The
missions are now heard opening
pm. The full schedule is 4.30-5
10.15-11.30 pm, 4.00-8.30 am. The
ation gives the address as Radii
Service of Information, Ivory Coa

RADIO TANANARIVE in Mad
shows a frequency change from
3232 Kc, using 5 Kw and carry
French Service, also on 9515, 61
3.30 pm, 7.00-9.00 pm, 1.00-5.30
other transmitters using 1 Kw
language, Malgache, on 7155,
3386 Kc 1 Kw, operate 1.30-3.00 p
6.30 pm, midnight 3.00 am.

BRAZIL'S Radio Central at G
being received strongly on 9775
opening at 7 pm. This station h
reported from Europe for several
in which area test broadcasts wer
on 11815 Kc. This latter frequency
in operation but suffers severel
jamming. The full schedule is 7
1 pm next day.

CEYLON has made some cha
the local Western program, which
broadcast on 920 and 5020 Kc w
10.30 pm-3.00 am, Sundays 2.30-
10.30 pm-3.00 am. The commercial
has also made some changes,
programs for Ceylon, English 11
2.30 pm 5.30-7.30 pm, 9.30 pm-
Sinhalese, 11.30 am-2.30 pm, 3.30-
Tamil 2.30-3.30 pm, 7.30-9.30 pm
usual frequencies.

DAHOMEY'S Radio Cotonou,
by the Government in the West
colony, has the mailing address
Box 366. The 1 Kw transmitter on
moved here from 4900 Kc, now t
9.40-10.00 pm (weekdays), 10.40-1
(Saturday), 3.30-6.00 am (Monda
9.00 pm, 3.30-6.00 am daily, rep
station in a verification to Worl
Handbook.

BANDUNG, Indonesia is now o
on 2420, 3205, 4945 Kc as follows, w
8.27-10.30 am, 3.27-5.30 pm, 7.30-
9.30 pm-1.30 am. Sundays 9
5.30 pm, 7.30-9.30 pm, 9.30-1.30 ar

DEUTSCHE WELLE in Cologne
assigned calls and frequencies, t
plete list as published in the 19
Radio Handbook, is as follows.
(3970) NDR, DMR25 (5980) DW,
(6030) SR, DMR27 (6075) NWS,
(6115) W, DMR29 (6160) BR,
(6190) HR, DMR30 (7170) DW,
(7205) DW, DMR32 (7265) SWF
(7290) DW, DMR35 (9735) DW,
(9640) DW, DMR40 (11795) DW
(11945) DW, DMR45 (15405) DW
(15275) DW, DMR50 (17815) DW
(17845) DW, DMR55 (21490) DW
(21650) DW, DMR60 (25650) DW
(25900) DW. Stations abbreviat
NDR (Nordwestdeutcher Rundfu
burg), DW (Deutsche Welle Colo
(Sueddeutscher Rundfunk Stuttg
(Bayerischer Rundfunk Munic
(Hessischer Rundfunk Frankfu
(Sued-Westfunk Baden-Baden).

Time used throughout is Au
Eastern Standard. Informatio
readers on the stations they ar
ing should be sent to Arthur
212 Farn Street, Invercargill

MADRID is using the new
transmitter on 5990 Kc in t
American schedule, which h
revised. Transmission is now
2.15-3.00 and 3.15-4.00 pm in E
North America, and the two ch
9368 and 5990 Kc are used. th
being very strong in this area.

HE HAM BANDS WITH BILL MOORE

lio amateurs, with the extension of their emergency net throughout parts of NSW can
idly supply communication if required. The operating experience gained in each
emergency is invaluable in improving the service available.

W, February, 1956, saw extensive
eur activity in the emergency
t was just 12 months since
s were active in the widespread
oods.

ur occasions in just over three
he NSW WIA Emergency Net was
tion during different emergencies
ount of traffic handled was not
or, in most cases, normal tele-
communications did not fail.

s necessary, however, to operate
g periods in view of the gravity
flood position in many areas
ensure that communication would
ediately available if required.

h instance the net operated until
ds abated and amateurs through-
State gave of their time in the
of the public.

areas during February recorded
aviest rainfall for many years,
20 inches in 24 hours in some
nd floods devatated many por-
the State.

rst emergency was on February
VK2WI first opened and the net
ed in operation for four days.
s over a wide area were active,
was possible that many areas
e flooded.

nost important work was con-
n two areas from Moree on the
and Richmond on the Hawkes-
ver.

first case the army authorities
station at Moree, the town was
communication and amateurs at
supplied a link back to VK2WI
y and to army "ducks" operating
work in the district.

umbewe, VK2ZX, of Inverell, was
open and finally operated on the
requencies 3382 and 6765 Kc/s,
ack Hill, VK2ADT, of the same
ovided the link back to the WIA

performed valuable work which
orded in a letter of appreciation
WIA from Moree municipal
es .

TO SYDNEY

other area where normal com-
ons failed was only 30 miles
ydney at Richmond where the
flood ever was recorded. Art
s, VK2AP, and his wife Jess,
, supplied the link to the out-
many hours. Richmond was com-
solated and important traffic was
requesting "ducks" and relief
viding information on the posi-

arrabri, where the Namoi was
Hart Wall, VK2JC, and Chic Macartney, VK2DK, were operating and for days supplied official bulletins hourly to broadcast station 2MO

This information allowed residents to judge the possible effect of the flood waters and to take the necessary action to protect their homes.

The station of the Hunter branch of the WIA, VK2AWX, operated by president Lionel Swain (VK2CS) was active and the Hunter net was operating when flooding along the Hunter was imminent. VK2WI was operated mainly by president Jim Corbin, VK2YC, assisted by council members. Stations throughout the State assisted relaying messages and acting as guard stations for the emergency frequency

Two weeks later the scene of activity swung from the north to the far South Coast of NSW.

Col Fletcher, VK2ASF, of Eden, opened and requested Harry Jackson, VK2AHZ, to notify VK2WI to stand by as that town was out of communication to the north. A considerable amount of PMG traffic was handled back to Sydney.

The following day the WIA net opened again when a cyclonic disturbance caused serious flooding on the North Coast of NSW. Amateurs right along the coast reported in on the net frequency.

AMATEUR LINKS

Murwillumbah was badly flooded and for nearly 24 hours was without contact with the outside except via radio.

Bill Campbell, VK2ZY, and Norm Carpenter, VK2RK, supplied amateur radio links as they have done in previous floods.

Traffic was handled for various bodies including the police, PMG, State Emergency Committee and B/C stations Bill opened early and reported moving his equipment on to crates and drums as the water entered the shack. The official net operated from Saturday until Monday. Also in the area Steve Grimsley, VK2VK, at Tweed Heads was active.

Bill, VK2ZY, operated with VK2WI while Norm, VK2RK handled telegraphic traffic with Stan Bourke, VK2EL, in Sydney.

As the disturbance moved down the coast other amateurs were active. iLsmore experienced serious flooding but communications held. Jack Hill, VK2ADT, in a central position gave considerable assistance to the net, many other amateurs too numerous to mention in detail also supported the work. The whole operation reflected credit on the work of amateurs in VK2 and VK4.

The final emergency session was on Friday, March 2, when another cyclonic disturbance caused serious flooding along the Hunter River. The net in the valley were active contacting official stations VK2WI and VK2AWX. Vic Holmes, VK2AKP, of Maitland, was requested to make his station available by the civic authorities. Messages were handled for the police but fortunately river levels fell rapidly as the rain ceased.

Some stations spent over 200 hours on the air during the above emergencies but compared with previous working little traffic was handled

MUST BE READY

Although some amateurs stated that time was wasted by prolonged net operation, it is imperative that the net must be ready to handle traffic immediately the position in any area deteriorates. Confusion was caused by amateurs taking instructions from local bodies on the subject of whether their services should be required. VK2WI should be contacted before deciding to abandon operating, they are the only station with a clear appreciation of the requirements generally.

Practically all of message handling was carried out on the 7Mc band which provided good signals throughout the evening. Spasmodic operation on the emergency frequency 7050 Kc/s caused some difficulty with stations outside the net operating, but fully co-operated by a rapid QSY.

The general concensus of opinion favors that amateurs should not move outside their own bands during emergencies if the full value of their work is to be recorded. Off frequency operation complicates the whole net as the control station cannot keep check on the general emergency picture. At times undoubtedly additional net frequencies are required but control should decide when and where.

The operator at the control station in contact with State emergency services and other organisations should be able to decide the better method of routing signals. Each operation sees an extension of civil radio nets in flooded areas. Most local authorities are taking action to ensure that communications in their areas do not fail.

A new departure for amateur activity in floods was recorded during the north coast emergency. Weather reports from many areas were supplied to the Sydney Weather Bureau. For a number of years now each major flooding has occurred during the week-end when the bureau has difficulty in receiving weather via the normal channels.

VK2WI collected weather reports from over 30 different areas on the Sunday morning and passed them to the bureau. The WIA received a letter thanking amateurs for their co-operation and it appears that this recording will become a permanent feature of amateur emergency operation.

LONG DISTANCE VHF CHANNELS

LTON, W1HDQ, in January QST
an insight into new commercial
hniques probably not known to
nateurs. In the US currently there
pression that the armed services
taking up long distance com-
on in the VHF and UHF
.

e long distance VHF com-
on is out of the laboratory stage
ny commercial firms are manu-
equipment and antennas for
nis field.

urs are familiar with tropospheric
g and with the aid of large
nd high power are making good
he phenomena.

provides communication up to
s or so. It must not be confused
opospheric bending or sporadic

been found another type of
g takes over somewhere about
s. scattering from the E layer region. It is effective between 25 and 60 Mc/s and puts a varying but reliable signal well beyond 1000 miles. The signal never fails if sufficient power is used.

It means the frequencies above 30 Mc/s will be in demand for commercial and military use, a phase never dreamed of until quite recently.

Undoubtedly amateurs will have to show they are making full use of their bands in the VHF spectrum to ensure their retention.

Tests on the 50 Mc/s band have been made by amateurs covering distances up to 1000 miles by means of ionospheric scattering. W1HDQ on test has been perfectly readable at all times at W4HHK the distance 1020 miles. The input used was 650 watts and the antenna a three over three array 60 feet high.

The advantages of VHF communication over HF working for point to point circuits are legion and undoubtedly full use will be made of this new development

SUNSPOT MAXIMUM

RADIO journals everywhere bring good tidings of a rapid rise in sunspots since the minima in 1954. The present build up is occurring at an exceptionally rapid rate and it is anticipated the next maximum will be of high intensity.

Professor Waldmeier of the Zurich Astronomy Observatory, expects the next sunspot maximum to surpass all sunspot maximums so far observed, and that the maximum may be reached as early as the middle of 1957. That would be two to three years earlier than the anticipated 11 year cycle.

Those that remember the propagation conditions of 1948, 1949, appreciate what to anticipate during the next couple of years.

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Price £9/10/-
LESS BATTERIES

• Transceiver Type 1045

V.H.F. approx 180 mcs.

Valve line up:— 2-RL181; 1-VR135; 1-5V4; 1-EA50; 1-RL37; 6-EF50; 1-6SN7; 1-GL2050 (Thyratron) 2-VR 150/30 (Voltage Regulators), 1-884 (gas triode). This unit also contains a motor-driven Selector Switch, two superbly designed Polystyrene six position rotary coil Turrets and an I.F. Transformer strip ideally suited for use with Television. Band width 10Mcs.

Complete Transceiver	£7/15/-
Turret tuned Receiver R.F. Assembly	£2/17/6
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I.F. Strip	£2/17/6

• Bendix Radio Compas
Rec.—M.N.26C.

MN26C. This unit tunes from 150K
to 1500 Kcs, which includes the maj
portion of Broadcast Band, making
ideal for use as a car radio. After mo
fications have been made will operate from 12 volts.

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• F.S.6 Transceiver

The ideal equipment for mobile or fixed station o
ation. Frequency coverage of 4.2 to 6.8 Mcs
807's on output. 6 volt operation.
This equipment has given excellent performance o
ating under the most adverse conditions. In good
dition, complete with Power Supply.

Price £29/10

• Transceiver R.T. 34/APS

Frequency modulated. Approximately 450 Mcs. V
line up:— 2—2D21 (Thyratrons); 5—6J6; 1—VR
9—6AG5. Complete with an in-built dynamotor.
volt 1.5 amp. Input: 285 volt 60 m.a. output.
conversion to 580 Mcs. Receiver contains P.P. Parallel Pulse Transmitter; also could be modified to 288-144 Mcs. Amateur Band

Price £1

• Beacon Receivers B.C. 1206

Small sized lightweight 5-valve Aircraft Receiver. Frequency coverage 195 Kcs to 420 kcs. Sensitivity 3 microvolts for 10 m.w. output. Power output 230 m.2. Current .9 amps 24 volts. Suitable for conversion to car radio. Height 4ins. width 4ins, length 6 3/8ins. Weight 4lb.

Price £5/17/6

Postage & Packing, 6d. Interstate 8d.

• Radio Marker Beacon Rec. B.C.357

This handy little Receiver unit make
an excellent capacity Relay whic
may be used as Burglar Alarm an
many other uses where remot
control of such things as garag
doors, gates, etc., is required. Co
tains one sensitive 10,000 or Rela
1-12SQ7; 1-12C8. A technical publication
available at most book shops and this give
conversion details on these sets.

Price £3/10/

ebruary monthly meeting of the
ivision of the WIA was handed
the division's VHF section which
ed lectures and presented a dis-
their equipment.

ent of the section Roy Hart,
explained the work of the group
pening address and related the
hases of operation and co-oper-
forded other bodies in the com-
ions field.

Vinch, VK2OA, then outlined the
mmunications work of the group
e Bush Walker's Club and the
ortable VHF gear used in the
en searching for lost persons.

lans for the next event in April
plained when a simulated search
conducted near Kurrajong in the
ountains.

Healy, VK2APQ, followed review-
144 Mc/s organisation used in
ion with the Spelaeological
in cave exploration. He spoke of
ents to be conducted later in the
when extensive work will be
out to make certain of the route
by signals and check the value
e-talkie equipment in communic
om cave to cave.

RETTE

nal lecturette was delivered by
Black, VK2QZ, who reviewed
ipment generally used on the
y members and explained the
equipment on display.

sing, the president VK2HO men-
ideals of the group and hoped
to see VHF links between all
or towns in the State. Each year
p takes over the February meet-
provides the members with an
nto activity in the VHF spectrum.

annual meeting of the Hunter
of the WIA was held on Friday
9. The following officers were
president, Bill Hall, VK2XT, vice-
ts, George Lee, VK2AGD, and
Whyte, VK2AHA, zone officer, Les
VK2AOR, secretary, Chas Arch-
K2ARV. The retiring president
Swain, VK2CS, did not stand for
on. Lecturer for the meeting was
wn Sydney VHF amateur Perc
VK2APQ.

econd combined outing of the
HF Section and the Sydney
ty Spelaeological Society was
Jenolan Caves on the week-end.
and 4.

r experiments were conducted
4 Mc equipment communicating
caves and to base stations out-
mountain. Bearings were taken
ansmissions. These were reviewed
eeting held after the event and
decided that signals from within
s to parties outside always took
rtest route despite any rock
n in the path.

cars carrying section members
d to the caves well equipped
walkie-talkie sets and seven
stations.

ers of the society reported that
s were in the wettest condition
d experienced and this was the
explanation that signals were
down in strength compared with
corded on the previous visit.

s observed that different rock
ns affected the penetration of
and when bedding planes varied
from the horizontal, serious
ion occurred, especially under
ditions.

e future the group hopes to
this attenuation as the bedding
the limestone is turned through
angles.

Healy, VK2APQ, was responsible
general organisation of the event.
Hart, VK2HO, recorded on tape
the proceedings and it is hoped
ll be the subject of an ABC
in the near future.

CTIVITIES

rowth of organised amateur radio
e US often astounds the average
. The ARRL as the National
now has 50,000 licensed amateurs
ers plus associates. It is antici-
hat 1955 will see the overall
of the league pass the million-
ark for the year. That is big
in any country.

eague's vast publishing business
urse mainly responsible for the
position. Publications cover
es of amateur radio from the
's "bible". The Radio Amateur's Handbook, to a licence manual for intending amateurs.

Most of the money is turned back to ensure the greatest service possible is given to members of the hobby

An indication of the increase in licences is given by the number of amateurs in 1931, just under 19,000. Current figures show an advance of 100,000 in the intervening 25 years.

With the advent of Novice Class licences in W-land, amateur radio clubs have received new impetus. Most clubs find the conducting of classes for novices well within their powers and they aim to assist as many enthusiasts to obtain licences as possible. Quite a number of commercial firms are running classes and the 5 WPM Morse requirement and limited technical examination can be attained in about two months by the average person.

Some of these novices are making a name for themselves in the DX field. Limited to 75 watts input and crystal control, a number of them have tallied 50 different countries on the 21 Mc band.

COMMERCIAL INTERFERENCE

MORNING DX sessions on the 7 Mc/s band are now practically an impossibility. Radio Pakistan, who has been causing serious interference for years on 7010 Kc/s, is now joined by Radio India an equally strong signal on 7035 Kc/s plus the many other weaker B/C stations around the frequencies.

For good measure Radio India also broadcasts on 7065 Kc/s. Seeing the Atlantic City allocations are not yet fully in force, possibly some of these stations may move later. It seems a forlorn hope, however.

Perhaps the next telecommunication conference will provide sufficient B/C frequencies for these newer nations and clear some of the din from exclusive amateur bands.

To "assist" in the general confusion on the CW end of the 7 Mc band, JA telephony stations are now appearing calling CQ CW. As these stations can use inputs up to 1 Kw they make a large dent in available CW frequencies. Radio Pakistan uses a power of 50 Kw, New Delhi, India, the bare 100 Kw on both frequencies.

QSL CARDS

Many of DX gang who have in more recent years attained the 200 countries contacted mark are badly lagging in their QSL confirmations. Generally running at least 20 QSL cards behind their countries worked list, they find it difficult to obtain high ratings in DXCC lists with so many cards outstanding. A number have decided the job of extracting these additional cards from the rare DX stations is an impossibility with so many amateurs placing no importance on the exchange of QSL cards.

Currently, in the UK, quite a controversy is afoot on the exchange of QSL cards and the statements on the art have varied fron an action "too puerile for coherent thought" to "the final act of courtesy after a contact".

Incidentally on quoted figures amateurs are receiving a 65 to 80 pc return for cards forwarded, VK stations recording the high average of 75 pc.

QSL cards from the US-KC4 gang in Antarctica cannot be expected before the ships return in 1957. Amateurs are assured that all QSO's will be confirmed.

Phan, 3W8AA, whose arrival on 14 Mc caused quite a stir is currently under a cloud. Phan gave his QTH as a post office box in Hanoi, Viet Nam, but XW8AB states no station operated from Hanoi. The amateurs in Ceylon always received him at S9 and had their suspicions but were prepared to accept him as legitimate. The DX gang can only hope, no news of mail returned from his address to date.

Russian amateur radio activity is still mainly restricted to contacts within the curtain. A few stations contact all and sundry but the general position remains an enigma. Europeans report they may QSO YU stations once again. The UA, UB's, &c., have been heard at excellent strength around 0600 hrs east on 3.5 Mc/s.

Recent visitors to Sydney included Dave Marks, W2APF, and Bill Mashek, WOJRY.

Uncle Dave is on a world tour and is looking up amateurs at all ports of call. Dave was out in the field with VK2WI during the National Feild Day. He has been featured monthly in QST in the advertising section for years now, looking out of a shack door smoking a large cigar.

Bill is doing the rounds on a Pacific tour and looking up his many amateur friends made during 30 years on the air. He was met at the boat by a number of VK2 amateurs.

Reg Tibbetts, W6ITH, during his vacation in February operated with the bare 1 Kw from Saint Martin Island in the French West Indies.

Operating on 14 Mc/s mainly, using CW and telephony he was very popular with the DX fraternity with the call FS7RT.

In mid-Febraury 14 Mc opened wide for the best DX experienced for many years. Europeans ran up to S9 and all continents audible in the late afternoon. It is a pity the BERU contest missed these good conditions by two weeks. 28 and 21 Mc also provided excellent DX.

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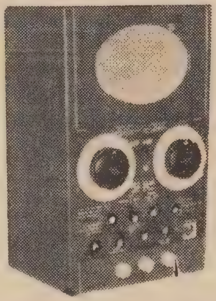

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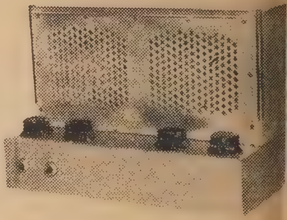

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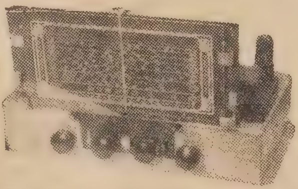

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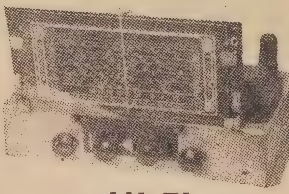

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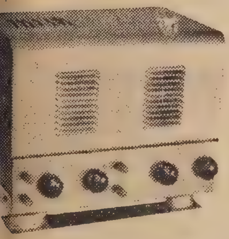

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AN ELECTRIC SHUTTER RELEASE

There are many occasions when a camera is used on a tripod, and at these times a
release is normally used to operate the shutter. A longer release is an advantage for p
raiture—particularly of children, and is essential for nature photography.

By A. J. LOWE, B.Sc.

THERE are times when a release should be many feet long, and in these circumstances an electric shutter release is ideal.

Some expensive Press cameras are fitted with a solenoid for operating the shutter and these can be used with a long lead for remote operation. However, for the usual run of cameras with a body release button, there is nothing available.

ELECTRIC RELEASE

This article describes an electric release made to fit an Ensign 820 camera. Detailed dimensions are not given, because the cameras vary so much that each constructor will have to adapt the ideas to his own camera.

The principle of this release differs from that of the usual solenoid-operated shutters. In them, a solenoid (i.e., an electro magnet) operates through a link on to the shutter tripping lever, on the front of the camera.

In this gadget, the body release button is operated by a spring which is held up at one end by a support. The support is pulled away by an electro magnet, thus letting the spring push on to the body release button and so operate the camera shutter.

This scheme has the advantage that the spring can be adjusted to operate a really stiff shutter, without having to make the electro magnet any stronger.

The framework (see figure 1) is made of ¾in x ¼in brass strip. It consists of a strip A running down the back of the camera, a short strip C and a longer strip B at right-angles to A. Another short strip D is fitted at right-angles to B.

These four parts are assembled by 1-8in screws, screwed into tapped holes.

CLEARS THE CAMERA

The upper strip B rests on top of the camera and has a hole drilled through it to receive the body release button. The lower strip C CLEARS the bottom of the camera by ¼in. This clearance is necessary so that the frame can be swung over the release button, and around the camera.

A ¼in threaded hole is made in the bottom strip and through this is screwed a tripod bush screw with a knurled head E, so that the framework can be clamped to the camera. A slip of rubber is inserted between the screw and the camera to prevent scratching the camera with the screw.

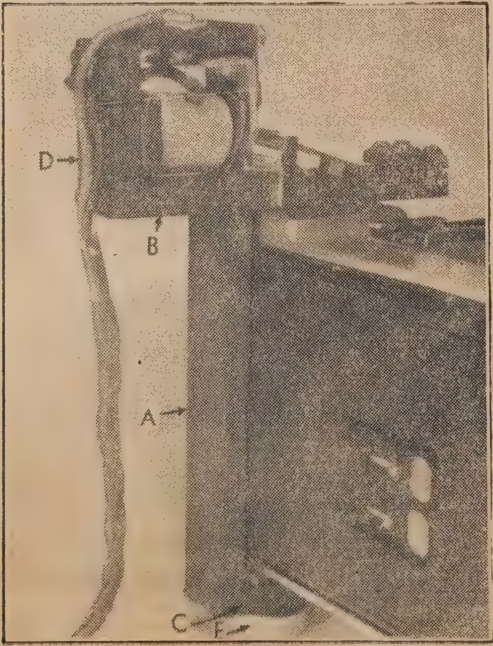


Figure 1 (left) shows how the electric shutter release is clamped to the body of a camera.

Figure 2 (below) shows a closeup of the whole trip mechanism.

On the top strip B and th
vertical strip D are the
See figure 2.

The electromagnet F on thi
was taken from part of a
cycle battery cut-out, but
electric buzzer or bell electr
net could be used instead.

The electromagnet must be
ed above strip B so th
armature can move freely. Th
ating spring G consists of tw
of clock spring. (A broken
can be got for nothing from
clockmaker.) These are
under a short section H
brass fitted at the forward
strip B, by four 1-8in scre

The lower spring strip is
(by heating to red heat and
slowly) at the rear end, and
over the upper spring strip.

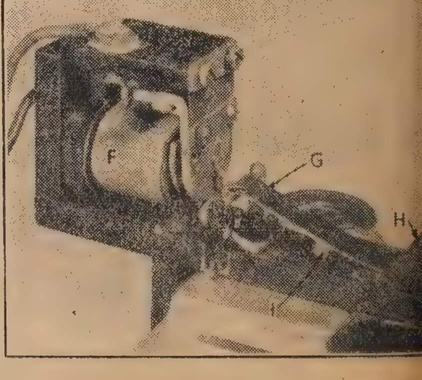
Soldered to the lower spri
is a finger I, which pushes o
release button and trips the

NOT ESSENTIAL

This finger was actually
the motor-cycle cut-out a
screw and has a ball-bearin
end. Such luxury is not
and a piece of rod with
filed hemispherical would do
well. The length of the fing
be sufficient to trip the
when the spring is resting f
the top of strip B.

The support J (see pictur
the rear end of the sprin
be sufficiently high, so
finger on the operating sp
turns far enough to let the
reset, when the spring is re
the support.

The support is the last
the works mounted on stri
consists of a rectangular fran
1in x 5-8in, made from tw
sides J and K, and a wir
and bottom.



vire is cut from a bicycle hich is stiff enough. The wire passes through a hole from side to side of the One side of the support assembled after the lower passed through the hole in The support frame, which ered construction, must turn the hole in B.

ed to the support frame is Bar M and back stop N. s also made of one piece e spoke. The trip bar runs with the top and bottom the support frame, and en- th the straight hook O sol- the armature of the electro

ack stop N must be ad- by bending, so that when ng is resting on the top the support frame, the sides upport frame are leaning a rees from the vertical to- e spring clamp end of B. simple toggle action.

ACTION

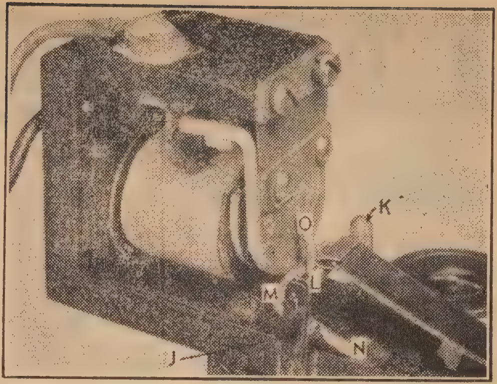
support frame leans too far it means that the electro would have to be very strong the frame across, to clear ng and trip the shutter.

ction is simple. The spring by hand, and the support wung underneath it. This the spring and operating ear of the body release but- e shutter is cocked. The nagnet is connected in series battery, and any amount of push button, to make the when required.

ishing the button, the elec- rcuit is completed, and the agnet is energised. This the armature and the hook away from the spring. This, se, pulls the support away der the spring. The spring own and presses the operat- er on to the release button. s the shutter. The whole s quick and smooth without e of jar.

important than when the is cocked on the support he amount overhanging the of the support frame shall tle as possible. This amount adjusted simply by sliding ng to and fro in the spring

is found that two trips of spring are insuffcient to the shutter, it is an easy o add more strips by fitting nder the spring clamp.



☆

Figure 3: Detail photograph of the toggle action which releases the spring when the solenoid is energised. There is virtually no limit to the distance from which the shutte can be tripped.

☆

The whole device will be found to be a useful addition to an accessory drawer, and so should be given a nice finish. Black crackle paint gives a satisfactory appearance and the easiest way of getting this applied is by giving the job to a typewriter mechanic who will have the necessary stoving equipment to make the crackle.

The gadget will be very helpful in photographing young children. The photographer can move right away from the camera, and direct his efforts toward getting the child to laugh (or cry), tripping the shutter remotely at the right moment.

w Oysters Grow

attempt to find out how fast yster builds its shell, scien- ve placed live oysters into containing radioactive cal- At different intervals oysters moved from the water, and nber of radioactive calcium absorbed into their shell with the aid of a Geiger

est showed that in little less ur hours the oyster accumu- measurable quantity of cal- the shell.

revent direct contamination e outside, the oysters were lacquer coat, so that only alcium atoms going through ter's body would be deposited shell structure.

Camera as Detector

AN ordinary camera can be used as a radiation detector. A photosensitive sheet is placed into the camera together with a sheet which fluoresces when subjected to X-ray or Gamma radiation.

When the camera shutter is opened, the radiation will increase and a light spot is recorded on the photosensitive layer, which indicates the strength of radiation.

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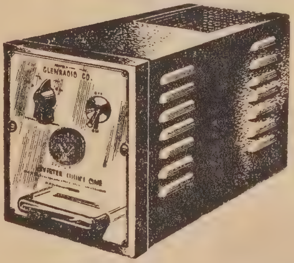
240 VOLT AC 50 CYCLE INVERTERS

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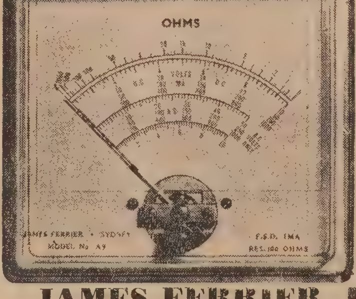
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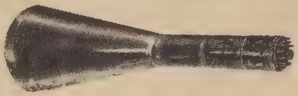


Cathode Ray Tubes

Type VCR138 3½ diameter, ideal for osciloscope, etc.

Characteristics:—

Filament Volts	4
Filament Current	1 amp
Anode 2	200 volts
Grid 1	— 50 volts
Diameter	90 mm
X Plate Sensitivity	— 14
Y Plate Sensitivity	.33
Anode 3	1200 volts

Electro-static deflection

Color Green

Socket connections can be supplied to each purchaser.

These valves sacrificed for 25/- ea.

5BP1 Cathode Ray Tubes. 39/6 ea.

VCR97 6 inch Cathode Ray Tubes. 39/6 ea.

VCR522 Cathode Ray Tubes, 1¾ inch screen. Characteristics:—

Filament Volts 4 at	1.1 amps
Anode 2	1.35 volts
Grid 1	— 20 volts
Anode 3	800 volts

Electro-static reflection.

Color Green.

Socket connections available on request. **Price only 25/- ea.**

954 Pentode Detector, amplifier, acorn type, 6.3 volts filament, ideal for high frequency work. **Price only 5/6 ea.**

VRL30 2-volt triode for battery sets fits octal socket. **Price 2/6 ea.**

6V6G Valves. **9/6 ea.**

12SR7 Metal Valves. 5/- ea.

NR74, 4-volt output tetrode (same as 807), each tube supplied with socket. **5/- ea.**

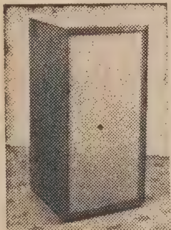
AV11—High voltage rectifiers. 7/6 ea.

1P5GT—1.4 RF Pentode. 6/6 ea.

1A4P—2-volt Var Mu Pentode. 5/9 ea.

717 A—U.H.F. Pentode, 6.3 volt filament, Octal Base; an excellent tube. **9/6 ea.**

1H4G 2-volt detector amplifier triode. **5/9 ea.**



Bass Reflex Cabinets

(as illustrated)

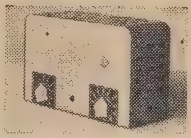
These cabinets are scientifically designed, built from heavy plywood, lined with heavy felt. Suitable for 12 inch speakers, Rola 12M, 120, 120X, and Jensen.

Available in Walnut, Mahogany and Silver Ash.

Price only £13/19/6.

plus Sales Tax.

Sales Tax Rate:——12½% for amplifiers; 16 2/3 pc for Tuners and Record Players.



3 Valve Amplifier

Specially designed for the reproduction of records. this 4 watt amplifier gives sufficient output for use in the home or small dance hall. All you need is a gramo motor with pick-up either magnetic or crystal to attach to the input of the amplifier.

A built-in output transformer gives output suitable for 1 or 2 Rola or Jensen speakers.

Overall size of the amplifier is 6½ x 10½ x 4 inch and tone and volume controls are provided. Finished in Silver-grey Hammertone.

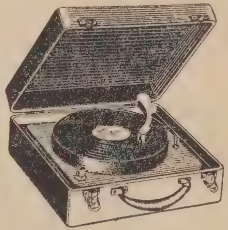
Price only £10/10/-.

Price of speakers to suit:—

8M Rola	£2/12/1
12M Rola	£3/4/10
7 inch Jensen	£2/8/10
12 inch Jensen	£2/17/-

Leatherette covered Speaker Boxes to suit:—

7 or 8 inch speaker	£1/16/9
12 speaker	£2/13/10



Record Player Amp.

Just landed another shipment of this popular line. This unit combines a 4½ watt amplifier with two inputs, one for the built-in 3 speed Phillips record player and one for a crystal microphone, each input with its own volume control. Also two outputs, one connected to the built-in 5 inch speaker and one for a separate extension speaker.

The case is finished in two-tone leatherette. Ideal for parties, dances or for playing records in the home. Worth £36/15/-.

Reduced to £19/10/-.

Extras if required:— Crystal Microphone. Worth £3/19/6.

Reduced to 35/-.

6 inch extension Speaker in leatherette-covered box. Worth £3/4/-.

Reduced to 42/6.

Also available same jobs as above, but without the microphone input and external speaker connections, but with tone control. Ideal for the reproduction of all types of records.

Price £18/18/- ea.

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1. Aluminium Chassis large drilled, 16 x 9½ x 2¼. **Sacrificed for 2/- ea.**
2. Coils wound on ribbed cer formers each with slug tu Diameter of former 7/8 length 2½ inches. These are for winding short wave coils. **Price only 2/9 ea.**
3. Car Radio Aerials, under rur board type with lead in anc tings. Worth £4/10/-. **Price only 45/- ea.**
4. Portable wind-up gramophon leaterette covered case; a reliable instrument. Worth 15 **Our price £7/19/6.**
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Prices per yd.

B & S	SWG	Enamelled	SCE
16	18	5d	6d
19	20	4d	5d
22	23	3d	3d
24	25	2d	2d
26	27	2d	2d
27	29	2d	2d
28	30	1d	1d
29	31	1d	1d
30	33	1d	1d

6. Bakelite Former available c the length you require.

Diameter	Price per ya
1 inch	5d
1¼ inch	6d
1½ inch	6d
2 inch	8d
2½ inch	9d
3 inch	10d

7. Brand new 7C7 Valves. **Price only 2/6 each.**
8. Brass Hinges, 8 inches long. type. **Price only 1/- ea.**
9. 5ft rubber covered twin cable phone plug fitted. **Price onl** ea.
10. Wire Wound Pots. Long brand new.
    - 3,000 ohm 4/
    - 25,000 ohm 4/
11. **Carbon Pots.** Brand new.
    - 5000 ohms medium shaft, 2/
    - 200,000 ohms short shaft, 1
    - 250,000 ohms long shaft . . 1
    - 500,000 ohms short shaft, 2
    - 2 meg long shaft . 2
12. **Single Pole Midget Relays,** 50 DC resistance, will operate vols. **Price 5/- ea.**
13. Miniature 7 pin Ceramic Sc with register. **2/- ea.**
14. 0-9 amp Hot Wire Ammete **10/- ea.**
15. 1000 ohm CT 8 watt resisto **1/6 ea.**
16. U.H.F. Ceramic coil former inch diameter, length 1 1/8 with mounting nut and slu **Price only 1/6 ea.**

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NSWERS TO CORRESPONDENTS

(Dalkeith, WA) asks if we have olished any articles describing capacitance relays".

capacitance relays we assume to a device which closes a cirie presence of a body such as sed for a burgular alarm. Such may have been mentioned in a vay somewhere in the magazine r as we know there has never tailed constructional article.

th Road Park, SA) is interested quipment and looks forward to iption of another oscilloscope in 7 & Hobbies. He suggests the e VCR139A CR tube. He is also building a resistance capacity ge.

ık you for your letter. It is en- to know that some of our ave the same thoughts on a new ourselves. As you say, the is well worthy of consideration, now that it is available through al commercial channels. It is a he small side, however, and we a screen diameter of about four a good compromise between ea and portability of the comstrument. Four-inch diameter available commercially but their gh compared with alternatives. ch diameter screen makes for a bly larger instrument but it remembered that large quantitP1 CR tubes are still available disposals dealers at very small r bridge circuit is similar to shed in the January, 1955, issue simpler version preceded this n in the December, 1954, issue circuits are available through service.

Tenterfield, NSW) writes to ask ents on mounting a loudspeaker g, the ceiling to contain a hornle.

true that both back and front orns can be designed for high and smooth response although he full advantages the overall may need to be very large. For n it has often been suggested speaker be mounted in walls, &c., and some enterprising audio s have actually gone to this

r, since so many aspects of gineering are subject to opposons many constructions like to r sound reproducing equipment le and easily modified form — e popularity of vented enclosere is yet another aspect of a speaker in a ceiling which considered on a personal basis. mostly accustomed to hearing me from ear level or below so reorientation would be necesr very kind comments are much ed. We will do our best to see opinion of the magazine does e for many years to come.

Kirribilli, NSW) suggests that designers have missed the bus hing) by not providing sufficient st for low level listening. Why npensated volume control, &c.?

ır letter raises a contentious ich could not be dealt with y in these columns. We have letter aside for possible dis- the "Let's Buy An Argument"

(Nanango, Q'ld.) inquires, t would be possible to use two d one 15 ohm loudspeaker with amplifier, with a view of hav- in three different rooms.

would suggest, M.J.G., that you ome of the transformer manu- advertising in this magazine, ain your requirements to them. eir many standard lines there be one with multiple secondings, which you would have to transformer would simply re- one in the amplifier at present, and the three different speakers would connect to the respective secondary windings.

J.R.P. (Nth. Balwyn, Vic.) asks if we have published the circuit of an intercommunication system suitable for use from room to room in the one building and enabling all remote stations to be called from any one position. He mentions some mains type valves he has on hand.

A. A number of intercom. amplifiers have been described in Radio TV and Hobbies but unfortunately none of them suits your requirements exactly. The nearest would be the "Improved Intercomm. Amplifier" which was described in the May, 1949, issue but this used miniature battery valves. It could perform the function you have in mind if a number of separate key switches were substituted for the rotary switch so that as many outgoing lines as required could be connected across the output of the amplifier. The "Two-Unit Intercomm." of the September, 1953, issue may form the basis of a suitable amplifier but the values of some of the small components would have to be altered to accommodate the valves you have. Copies of the circuits are available through the 2/- query service.

C.G.M. (Dunedin, NZ) sends us a circuit of an amplifier suitable for use with crystal pickups, for the "Reader Built It" page. He states that he only marked the important values of resistors and capacitors on the circuit, the unmarked ones being "conventional values".

A. Thank you very much for the circuit, C.G.M., we will file it for possible later use. There are a few points, however, which we feel have to be mentioned. You state the sensitivity of the amplifier as 1 V for full output. This can only apply with specified values of plate and screen resistors, as well as with a specified amount of feedback. It would therefore be impossible to say from the circuit just what the sensitivity would be. The bass boost system is also open to some criticism. Voice coil feedback lines are essentially low impedance circuits, and a 1 meg. potentiometer in this circuit would give very sudden control near one end of its travel and very little over the remainder of its path. A 5000 ohm potentiometer would give much smoother control. For true bass boosting the capacitor across the control would also have to be a much larger value, of the order of .1 or .2 mfd. Because of instability problems, the tendency is away from tone controls in the feedback circuit at the present moment.

C.G.G. (Copley, SA) has a vibrator receiver which is giving trouble and also a lighting plant which causes interference. He wants to know if we can help.

A. Sorry, C.G.G., but we are afraid the set is a job for a serviceman. We couldn't even start to guess where the trouble could be. Regarding the lighting plant it is important to determine whether the interference is due to the generator brushes or the ignition system. This can be checked by observing the interference when the ignition is cut briefly. If ignition is the trouble we suggest a standard ignition suppressor in the HT lead from the coil. In addition one side of the generator output should be earthed if it is not already and the other side by-passed. A .1 mfd to .5 mfd capacitor should be adequate for the purpose.

H.W.P. (Charleville, Qld.) while renewing his subscription to Radio TV and Hobbies thanks us for past efforts and expresses his good wishes for our future success. He also mentions that he would like to see some articles on transistors particularly of a theoretical nature. A circuit of his own is included for our comment.

A. Your subscription has been passed on to the department concerned and an appropriate note made. We read your remarks with regard to future articles with interest. It is not possible to make definite promises but we will do our very best to see that readers are kept up to date. In principle the detector and audio section of your circuit appears to be in order but we do not recommend the OC70 as an RF amplifier. Until the manufacturers are able to make a high frequency transistor available it will be desirable to use a valve in this position.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

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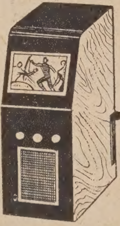

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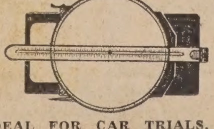

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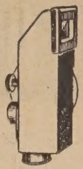

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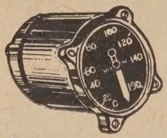

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50 Volt 1/40 H.P. Brand New.
3 Phase
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Collar. Guaranteed 100 per cent.
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Interstate 9/-.

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21 x 15	£5/13/6

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Green C
(non-scra
Extra G
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6 x 8
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with Zipped Detachable Lar
Lining and Collar. Definitely th
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WAS £1000.
Dimensions are 3ft high, 12in
Weight approx. 80lb.

Price £20

Freight payable at nearest at
railway station.

RANSMITTER ..

tinued from Page 111)

600 volts. This, of course, make any provision for the r and the complete power likely to be a heavy and e item.

ve further ideas on this and hope that we will be discuss them in more detail r date. In brief, the ratings power transformers are t on the basis of continuous . The limiting factor is ure which if allowed to rise will prejudice the insulat- rials of the transformer.

er, transformers have long time constants compared er items such as valves and and therefore it is perfectly e to run them with higher rmal loads, provided the period is not too long. m transmitter a reasonable ay be for 50 pc of the period aximum "on the air" period nutes. In this way it should ble to rerate the power ner with a considerable in- the available current.

r to the matter of power you will note that in the simple version of the trans- e have made no provision tching the low powered on without the final am-

ON FOR NETTING

rovision is extremely valu- en you wish to steer your o a vacant spot in a crowd- or net with another station. be arranged by placing a eturn switch in the high ead and an additional series o the main power supply. possibility would be to build supply with a small instru- e power transformer on the assis.

ansmitter design we have d may be considered as d lends itself to an almost e number of additions and ions some of which we will discuss soon. In the mean- are impressed with it as the neatest and smoothest that it sets a new style of ers we have yet handled er inside the 100 watt limit. ain thing, of course, is that components which can be d readily in this country.

The Serviceman Who Tells

tinued from Page 63)

e motor idle," I yelled, and eed dropped away, the cut- ed open. Very gently I against the metal flap and el quite distinctly a pulse ied to close the cutout at a y which I soon identified speed of the generator pul-

er," I said, "unless I'm very istaken, you've got a worn hich is only touching the tor at a high spot."

e I'd better try and fix it," ed, looking into the gather- n.

You're right! That was all the excuse needed for our respective wives to go inside for a mag and a cup of tea. We mugs, in the meantime, had to take out the generator and see what could be done.

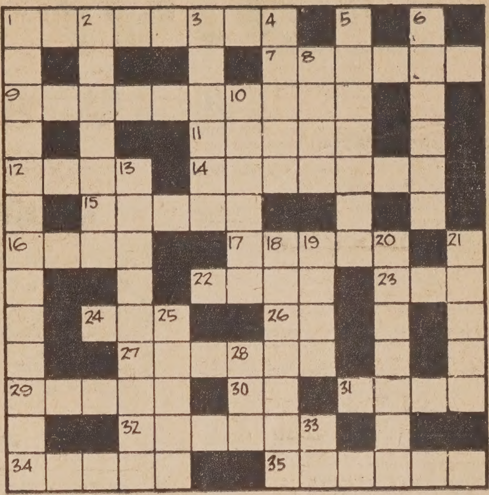
Fortunately, it wasn't a long job and a few minutes' work verified the diagnosis. Both brushes were badly worn, one of them to the extent that the spiral spring pressing it against the commutator was resting against the brush slide.

We put in a piece of packing as a temporary expedient, leaving my friend with the knowledge that he'd have to get all greasy again tomorrow evening—or else take the car to a mechanic.

The main thing was, of course, that he was able to drive home again that night, without having to share our beds as well as our larder.

Which all goes to show that a little knowledge of electrical things is a good thing in this modern world. You beaut! That's the moral I was looking for!

THE R. & H. CROSSWORD No. 24



ACROSS

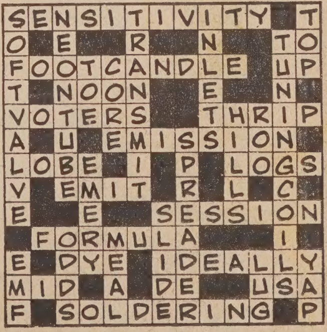
1. Valve element
7. Electro-magnetic switches
9. Used for UHF resonant circuits (2 words)
11. Unit of heat
12. Latin for fountain
14 Plain-weave fabric
15. Coppice
16. Mark to show pitch in music
17. Surname of an English radio pioneer
22. Large continent
23. British Broadcasting Corporation (abbrev.)
24. Automatic volume control (abbrev.)
26. Low tension (abbrev.)
27. Peruvian sheep
29. Fleshy part of the palate
30. French for "the"
31. Sound of escaping air
32. Ancient northern sea-rover
34. Tribal emblem
35 Valve element

DOWN

1. Prevents harmonics radiated from Xmitter antenna
2. Document giving formal permission
3. Grounds
4. Endeavors
5. Famous inventor
6. Impregnating with coloring matter
8. Makes mistakes
10. Discs with spokes revolving on axles
13. Gassy tube (2 words)
18. Lubricating container (pl.)
19. Prescribed information
20. Rubber vulcanised with sulphur
21. Action of a beam of light in TV (pl.)
25. To demand as a right
28. Turkish name
33. General Commander (abbrev.)

Solution and further crossword next month.

Last Month's Solution



S	E	N	S	I	T	I	V	I	T	Y	■	T
O	■	E	■	■	R	■	■	N	■	■	T	O
F	O	O	T	C	A	N	D	L	E	■	U	P
T	■	N	O	O	N	■	■	E	■	■	N	■
V	O	T	E	R	S	■	■	T	H	R	I	P
A	■	U	■	E	M	I	S	S	I	O	N	■
L	O	B	E	■	I	■	P	■	L	O	G	S
V	■	E	M	I	T	■	R	■	L	■	C	■
E	■	■	E	■	■	S	E	S	S	I	O	N
■	F	O	R	M	U	L	A	■	■	■	I	■
E	■	D	Y	E	■	I	D	E	A	L	L	Y
M	I	D	■	A	■	D	E	■	■	U	S	A
F	■	S	O	L	D	E	R	I	N	G	■	P

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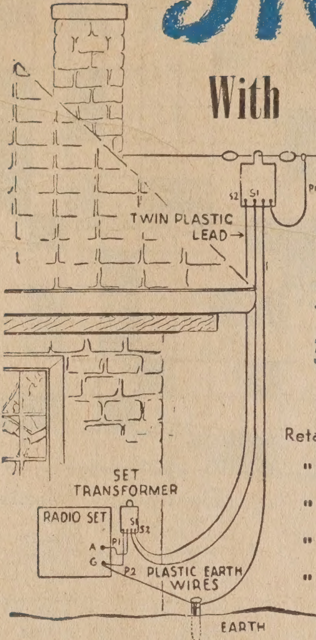
STOP NOISE

I YO SU

With R.C.S. aerial and line filters

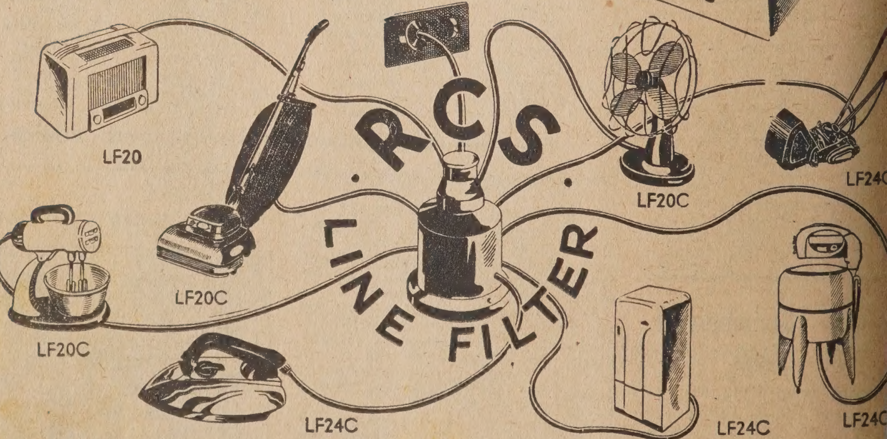

S2
S1
P1
TWIN PLASTIC LEAD→
SET TRANSFORMER
RADIO SET
A
G
S1
S2
P1
P2
PLASTIC EARTH WIRES
EARTH

MAKE THIS SIMPLE TEST:—

1. Remove aerial from set. If the noise stops, you need an AF21C aerial filter, as the noise is coming through your aerial.
2. If the noise continues, you need an LF20 line filter as the noise is coming through your power main.
3. If any of the appliances shown below are causing the noise, then fit to it a line filter of the type shown.

Retail AF21C aerial filter	140/-
" LF20 line filter ..	37/-
" LF20C " " ...	42/-
" LF24 " "	50/-
" LF24C " "	55/-

CONFINE NOISE WHERE IT STARTS WITH R.C.S. LINE FILTER


R.C.S.
LINE FILTER
LF20
LF20C
LF24C
LF20C
LF20C
LF24C
LF24C
LF24C

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